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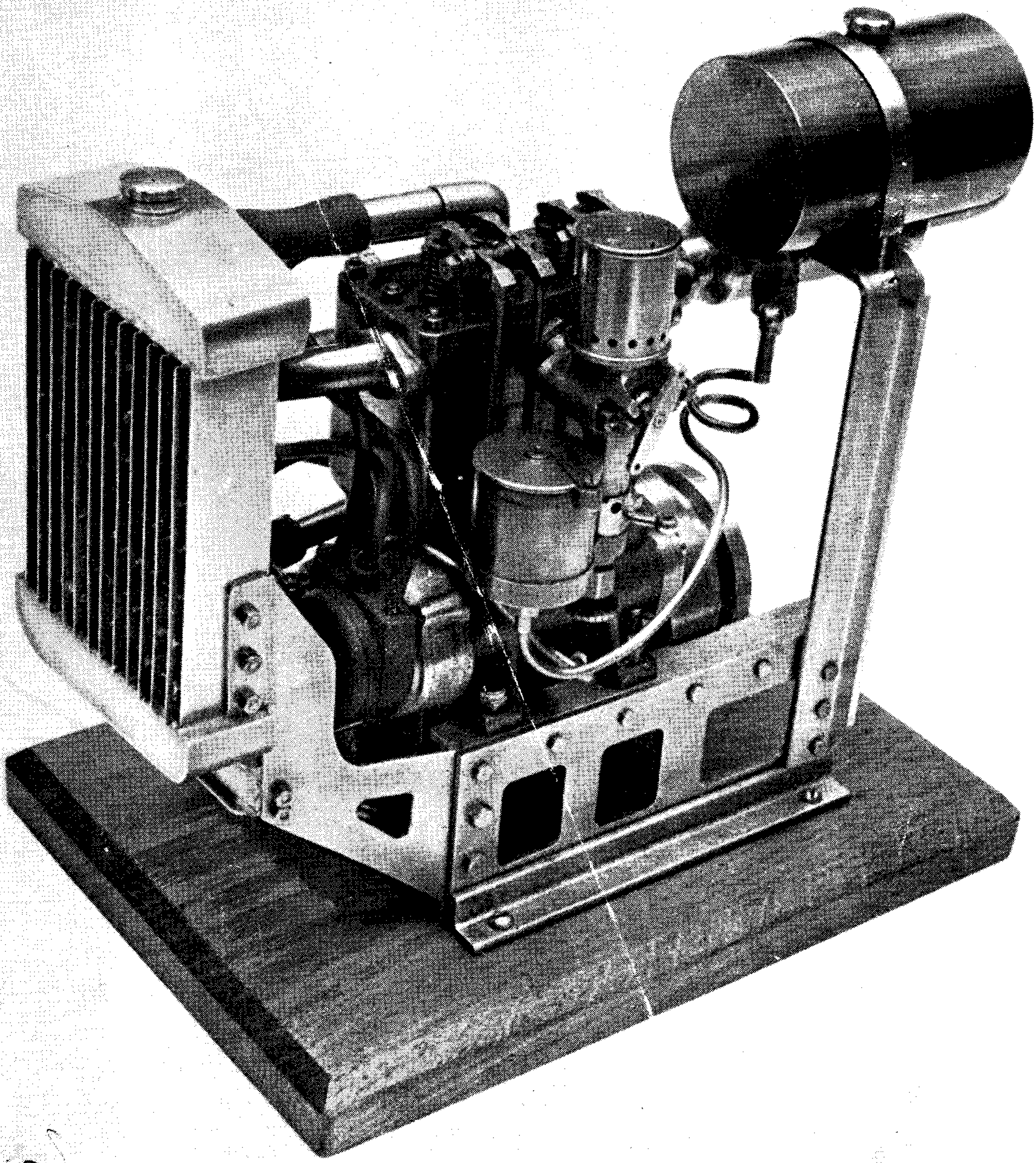
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST., LONDON, W.C.2*

12TH JUNE 1952

VOL. 106 NO. 2664

SMOKE RINGS

Our Cover Picture

● THE ENGINE illustrated in this photograph is the 30 c.c. o.h.v. twin designed for the "1831" locomotive by Mr. Edgar T. Westbury, as constructed by Mr. Alan Brookes, of Warrington, Lancs, who proposes to use it as the power unit of a model tractor. Apart from the bearer frame, the fuel tank, and the very handsome radiator, the engine follows the published design closely, including the automatic carburettor, high-tension distributor and forced lubrication system, but not, at present, the centrifugal clutch, which was incorporated in the design to reduce the risk of stalling the engine when starting off with a heavy load. Mr. Brookes states that this is his first attempt at building a petrol engine, but with the aid of the instructions and drawings published in THE MODEL ENGINEER it was carried out quite successfully, and except for minor teething troubles, its performance has been highly satisfactory. The "1831" engine has been built by many of our readers, for various purposes, including the propulsion of prototype boats, where its flexibility and quiet running are important assets. It produces ample power for driving a 6 ft. liner or cargo boat, and at least one boat fitted with this engine has made many appearances during the last two or three regatta seasons.

Exhibition at Port Talbot

● A MODEL and Hobbies Exhibition organised by the Round Table Society, Port Talbot, in aid of charity, is to be held in the Drill Hall, Forge Road, from June 17th to 21st. Admission 1s. for adults, 6d. for children ; tickets obtainable at the door.

Mr. D. Elwyn Evans, hon. secretary of the Port Talbot Society of Model Engineers, tells us that his society will have a good display of models and about 100 ft. of track for passenger-hauling locomotives in the exhibition.

Sydney S.M.E.E.

● A COPY of the Sydney S.M.E.E. *Bulletin* for May has reached us, and from it we learn that the society celebrated its 44th anniversary in April. We offer our congratulations—unavoidably late, but none the less sincere—to our Australian friends, and at the same time we extend out best wishes for continuing success in the future ; we are sure that our sentiments will be echoed by model engineers everywhere. Six more years, Sydney, and you will score a half-century !

The 44th "birthday" was marked by a fine display of models and what seems to have been a generally happy get-together at the society's

clubroom in Ashfield, and was attended by the Mayor of Ashfield, Alderman R. W. Murden and Mrs. Murden. To us, this kind of celebration is all the more remarkable when we remember the difficulties in which our hobby is catered for and carried on "down under." Materials, castings and parts are hard to come by; most of them have to be purchased from outside of Australia, making them subject to duties, tariffs and taxes which add enormously to the cost.

Fortunately, however, enthusiasm of the really active kind seems as keen in Australia as it is anywhere else, so that model engineering can flourish there in spite of everything. We are glad to learn that, after waiting for a very long time, the necessary timber required for rebuilding the Sydney society's locomotive running track has, at last, been delivered. We do not think that the society will now have to wait much longer before the trains are running again.

A New Lightweight Diesel Train

● BY COURTESY of the Railway Executive, we were privileged to witness a trial run from London (Marylebone) to Gerrards Cross and back, on May 23rd, in a new lightweight diesel train recently built by A.C.V. Sales Ltd.

The facilities afforded by British Railways for these trials form part of a special study which the Railway Executive is already making of the possibilities of light units generally for developing traffic, and for working it more economically, both on branch line and on suitable main line services. As part of the same policy an improved type of steam "push-and-pull" train is being tried out in the Western Region, on the Ealing and Greenford service.

Following the present service trials of the A.C.V. demonstration train, it will be used experimentally on public services on outer London suburban routes during "off-peak" periods.

The basic principle of the experimental train is the application to a railway vehicle of selected features of bus and coach design (including mass-produced power units already in use in London's buses and all over the world), added to the great advantage which a railway vehicle possesses in its much lower rolling resistance, and the easier gradients which it uses. The designers have aimed, in fact, at a unit which combines the best features of both rail and road vehicles, and which, apart from its possible use in the British Isles, will it is hoped prove capable of development in the export field.

Compared with a normal railway coach 60 ft. long and weighing 30 tons, one of the motor cars of the lightweight train, plus one trailer, has a combined length of 80 ft., and including all power units, the weight is only 25 tons. In other words, the new-type cars with 20 per cent. more space weigh 15 per cent. less, quite apart from locomotive weight. In slack periods the motor car can shed its trailer and so reduce the weight to 15 tons while retaining a capacity equal to the traffic available.

Other advantages claimed by the manufacturers for this type of lightweight train include:—Quick turn-round at stations—can be driven from either end; low wear-and-tear and maintenance costs, due to lightweight construction; no fuel burned while train is not actually in operation; fuel consumption under variable service conditions is about 11 miles to the gallon for each power car, or 5½ miles per gallon for the three-car train; economy in man-power—train is operated by driver and guard only.

The Weymouth M.E.S.

● A LETTER from Mr. H. W. G. Swindell, hon. secretary of the Weymouth and District Model Engineering Society tells us that, at the society's third annual general meeting, a very satisfactory condition of affairs was disclosed; the balance-sheet showed a sound financial position.

The meeting agreed that the exhibition held last summer was so encouraging that another should be arranged this year. Accordingly, the Melcome Regis Boys' School has been booked for August 20th-23rd, next, and the members have decided that the exhibition shall be confined to work by the society alone; they are all keen to make the show a success.

The present executive officers were re-elected for a further term of office, and the president, Mr. J. Moor Ward, closed the meeting with an appreciation of the executive officers' services during the past year.

Like most other societies, Weymouth is always ready to welcome new members; a cordial invitation is extended to model makers in the district to share the society's activities and workshop, which includes the use of a modern machine shop. Meetings are held every Thursday at the Cromwell Road Boys' School, 7 p.m. till 9 p.m., and any further information can be obtained from Mr. Swindell, whose address is 27, Leamington Road, Weymouth.

News from Cape Town

● WE HAVE received a letter from Mr. S. H. Ward, hon. secretary of the Cape Town Society of Model and Experimental Engineers, who tells us that the society's forty-third annual general meeting took place during April. Mr. A. G. MacMahon was elected president, and Mr. R. C. Chapman has become vice-president. Mr. Ward fills the dual post of secretary and treasurer, and the new committee consists of Messrs. Baker, de Gruchy, Ellis, Hiley and Wintle.

Although a satisfactory year's progress was reported, lack of a suitable workshop is felt to be a handicap. Negotiations are in hand for renting a piece of ground in the southern suburbs of Cape Town, and there are hopes that the society may be able to take possession before long.

Meanwhile, the portable passenger-carrying track was in use at a number of fetes during the past twelve months, and good progress is being made on the construction of a 3½-in. gauge 2-6-0 coal-fired locomotive and the "OO"-gauge sectional layout which is being arranged on the stud-contact system. Also, the society has acquired the fine "1"-gauge layout, comprising some ten pre-grouping locomotives and appropriate rolling stock, which belonged to the late Mr. John V. Muller.

MARINE MODELS

AT THE NORTHERN MODELS EXHIBITION

by " Northerner "

WINNER of the First Prize in the section devoted to Working Model Yachts and Sailing Ships at the 1952 Manchester show of the Northern Association of Model Engineers, was Mr. G. R. Sinclair's Thames Sailing Coasting Barge *Youngarth* (Photographs No. 1 and 2). This excellent model, incidentally, won a Bronze Medal and Diploma at the " M.E." Exhibition of 1923, so that she has had a good long life, with many more years to come, by the looks of her.

The model is to ½-in. scale, and is a replica of a real prototype of which Mr. Sinclair's uncle was skipper. It is a tribute to the correctness of everything about her that the small *Youngarth* was for a period in the boardroom of the firm who built the prototype, and not even the shipwrights or skippers could find fault with her!

Principal dimensions are L.O.A. 5 ft. 8 in., height to top of mast 3 ft. 6 in., hull 3 ft. 5¾ in. long by 10¼-in. beam, midship sides 4½ in., stempost 7 in., stern-post 5½ in.

Construction of Hull

The keel, stem-post, stern-post and ribs are of oak, clad with planking of cork pine $\frac{3}{16}$ in. thick. The planks are $\frac{13}{16}$ in. wide at the maximum, and had to be steamed to be fitted.

There are two holds, that in the fore having six hatches, and the main with ten. All the hatches have oak beams with white-wood planking, and are correctly battened down with riveted-on lugs.

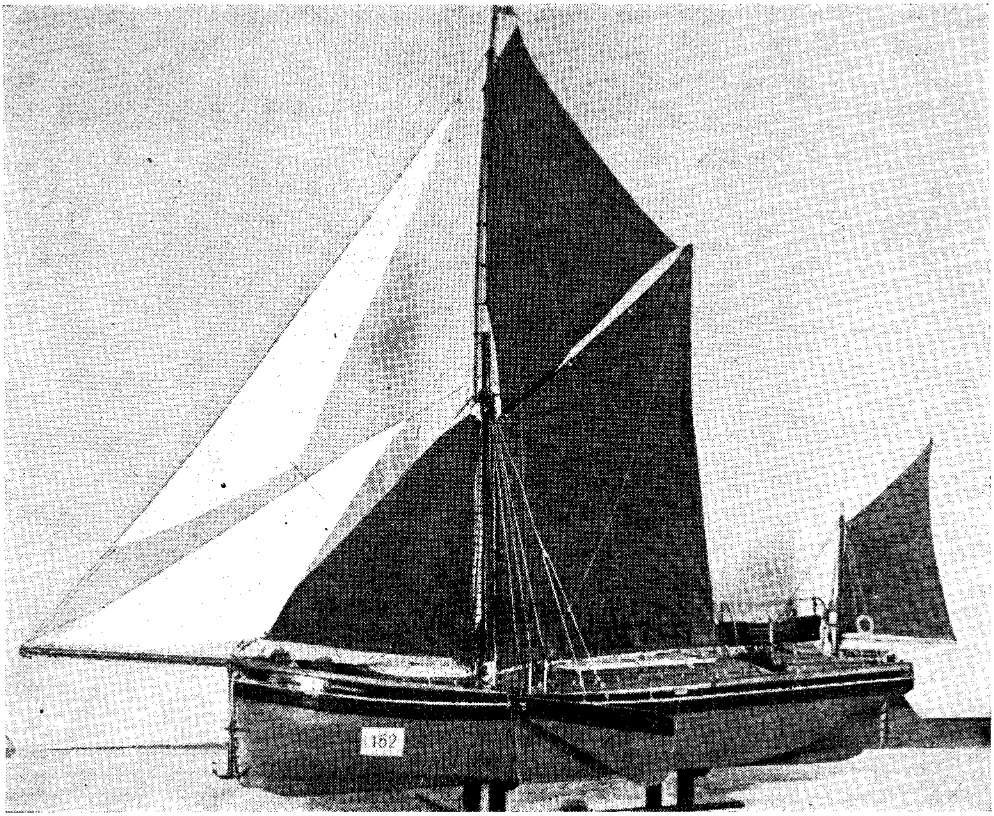


Photo by] [*Arthur Hamer, Whitefield*

Photograph No. 1. *A well-detailed model of a Thames sailing barge built to ½-in, scale by Mr. G. R. Sinclair, of Exeter. This model has been sailed regularly on the open sea, as well as on more sheltered waters*

Masts and Rigging

Timbers used for the masts are correct to the prototype, pitch-pine being used for the main and mizzen masts and the bow-sprit, with a topmast of fir. Main sprit, mizzen sprit, and boom are of larch. (Surprising what one can learn at an exhibition !)

Shrouds and running-gear are brass wire, with all cordage correctly laid. The blocks and dead-eyes are of boxwood, except for the stem blocks, which are of aluminium, with brass wheels.

Balloon cloth was used for the sails, all except the jib and jibtopsail being dyed red ochre.

Full deck fittings are carried.

All deck-winches are of brass, with gears from an old clock ; a main anchor and sheet anchor were cut from steel-plate. Screw steering gear with a left- and right-hand thread (Taylor's patent) is used, all built-up, and the steering wheel in brass. There is a mahogany binnacle with a real compass.

The dinghy is carved clinker-built, and the davits are swung in. Beads form the "lenses" of the sailing-lights, the bodies of which are cut from aluminium. Lifebuoys are mahogany, painted white.

Painting is to "standard" colours ; the hull is black (to represent blacklead) and the cabin-top, quarter-board, and coamings are grained. Talking of the cabin, by the way, it should be mentioned that this is fitted out with lockers, doors, oilcloth on the floor, ladder, and skylight.

Photo by courtesy] [*G. R. Sinclair*
Photograph No. 2. *Mr. Sinclair's barge under sail in quiet water, on the Exeter canal*

Performance

This fine vessel has sailed on the open sea on very many occasions—off the Nore lightship and off Exmouth particularly. She will sail without ballast, when she draws $1\frac{3}{4}$ in. but for convenience a false keel of 7 lb. weight has been fitted, when her draught is $3\frac{1}{2}$ in. In this condition she can sail fully-rigged in very fresh breezes and Mr. Sinclair says he has to row hard to keep up with her.

At the exhibition, this marine enthusiast had a further excellent working sailing-model—the "J" class cutter *Sans Pareill*—and he tells me that he is now at work on a scale model of the old paddler *Royal Sovereign*, which is to be fitted with diagonal engines. Perhaps we shall have the pleasure of seeing her up north some day, too.

A Cabin Cruiser from Oldham

Unfortunately I did not have the opportunity of an interview with Mr. C. Taylor of Oldham, who built the beautiful $\frac{1}{2}$-in. scale cabin-cruiser shown in Photograph No. 3. Furthermore, owing to an unfortunate mischance, I could not make a really prolonged examination of the boat itself, so must apologise to Mr. Taylor and to readers for not being able to give many details of the model.

The photograph, however, shows that the lines,

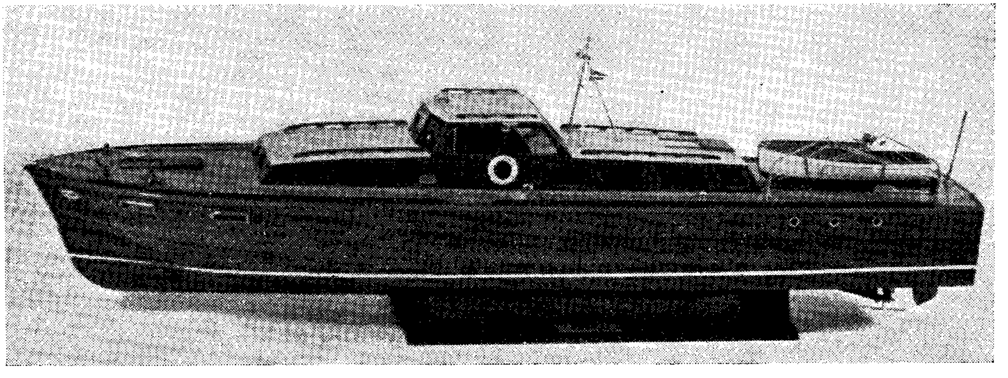


Photo by] [*Arthur Hamer, Whitefield*
Photograph No. 3. *A handsome $\frac{1}{2}$-in. scale twin-screw motor-cruiser built by Mr. C. Taylor, of Oldham*

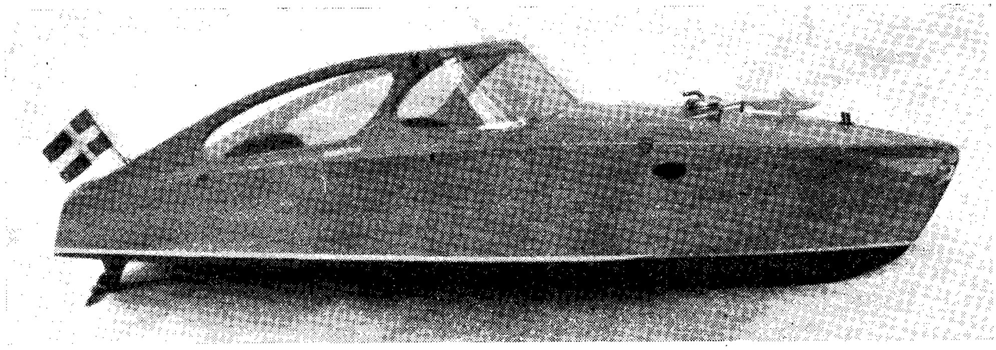


Photo by] [*The Author*
Photograph No. 4. A diesel-powered speedboat from Sweden, built by Mr. Erik Gronqvist, of Hagersten

the finish, and the detail work are excellent. Deck-fittings include a roller at the stem-head for the chain-cable of the anchor, a C.Q.R.-type anchor, a windlass, mooring-bitts, fairleads, bollards, and mushroom ventilators. An electric horn and d.f. loop are fitted to the cabin-roof, and navigation lights, port and starboard, to its sides. The steaming-light and anchor light are fitted to the tripod mast.

Two boats are carried, the larger one being hoisted in- and out-board on davits. The smaller dinghy has a realistic-looking outboard motor fitted to the transom. Both boats are well-detailed, with internal fittings, including ribs.

This cabin-cruiser, which is electrically propelled, was awarded First Prize in its class.

A Model from Sweden

In the International Section of the Exhibition, there were several entries from Sweden, thanks to the co-operation of our Swedish contemporary *Teknik for Alla*. One of these was the very pretty hard-chine speed-boat shown in Photographs No. 4 and 5, and built by Mr. Erik Gronqvist of Hagersten.

As the photographs show, this model possessed particularly lovely lines, sweeping, graceful, and well-blended. The hull, which was perhaps 16 to 18 in. long, appeared to be built either from veneers or from very thin plywood, the lighter panels on the decking being inlaid, as were the names and emblems at the stem and transom. The whole was nicely polished.

In the semi-enclosed cockpit upholstered seats were fitted ; and a dashboard complete with " instruments " added to the realism. A delicate steering-wheel in ivory plastic was at the port side. The curved windscreen was moulded from celluloid or thin Perspex, with side windows of the same material.

A 2.3 c.c. diesel engine is fitted under the foredeck, with the cylinder-head just protruding. The exhaust ports project from the sides of the hull. There are two tiny bridles fitted at each

(*Continued on page* 758)

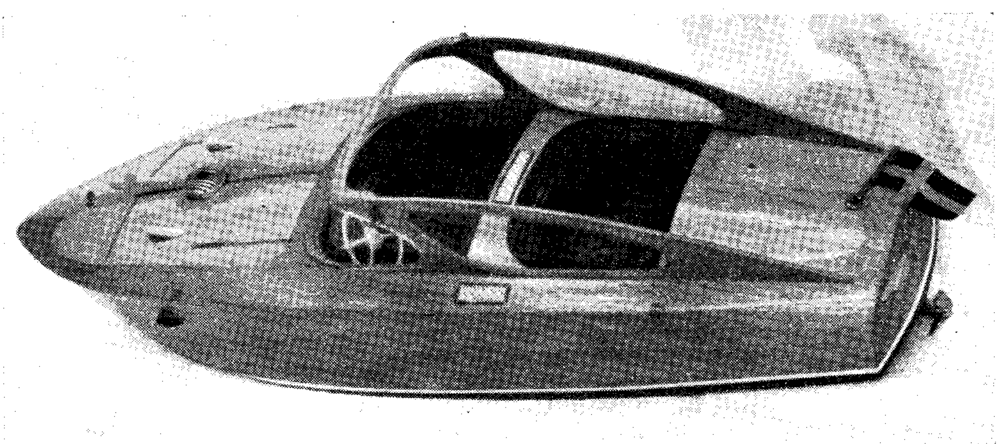


Photo by] [*The Author*
Photograph No. 5. Another view of the Swedish speedboat which helps one to appreciate her lovely lines

*A Portable Tape Recorder

With Notes on Magnetic Recording

by Raymond F. Stock

THE record head is the most important component in the apparatus.

It was built up from two stacks of 12 laminations, all cut from mu-metal to the shape shown in Fig. 20, the mu-metal (an essential material) being cut from transformer laminations specially purchased.

After filing to shape, each stack was bound with wire and the ends of the limbs (surfaces **A** and **B** in Fig. 20) were stoned true.

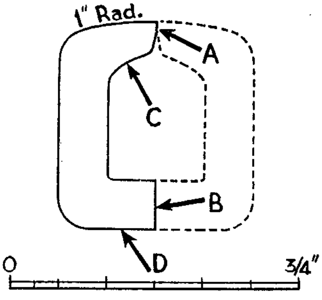


Fig. 20. *Record head lamination*

The two half-cores were then packed in magnesium oxide inside an iron box and brought to yellow heat for an hour, afterwards being allowed to cool down slowly overnight. This annealing process is an essential one as mu-metal loses its special magnetic properties after vibration, etc. caused by working.

When the cores were cold, the wire binding was removed and the oxide dusted off, carefully preserving the sequence and position of the laminations. Edges **C** and **D** were then lightly scraped to facilitate tinning, and the two stacks reassembled in order, keeping the stoned edges flush and the front radius lined up. Edges **C** and **D** of each stack were then soldered together leaving a fair thickness of solder on the rear faces **D**.

The surfaces **A** and **B** were then finally trued on a fine oilstone and each half core was then ready for winding.

Silk insulation was placed over the centre portion of each half and a coil wound consisting of 80 turns of 28-g. enamelled wire, covered overall with silk tape.

The two half cores with their coils were then brought together with the ends of their limbs touching and a thin shim (of cigarette paper) inserted between the front joint ; this forms the thin gap in the working face, and the rear gap, butt-jointed, is ignored and plays no part in the recording process, being no more than a manufacturing convenience.

With the two parts pressed tightly together the faces **D** were then soldered to a previously tinned mounting bracket, after which the front (working) face of the core was finished on a fine oilstone. It is important that this face should present a smooth even curve to the tape and if correctly made the individual laminations and the gap are both hardly distinguishable.

The two coils were connected in series (pre-

**Continued from page* 731, "*M.E.*,", *June* 5, 1952.

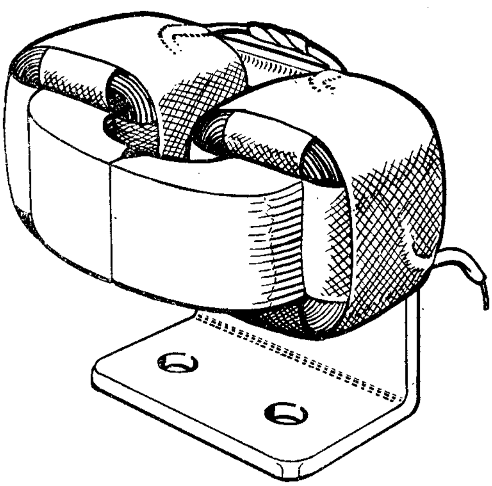


Fig. 21. *Record playback head*

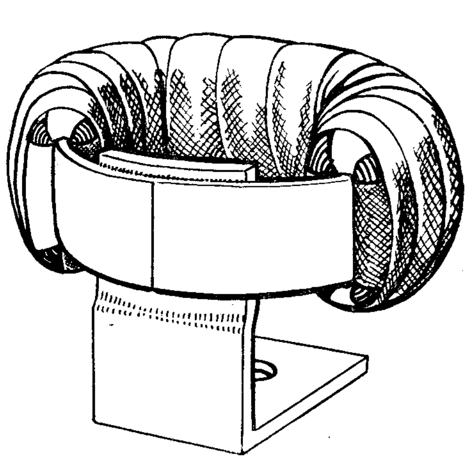


Fig. 22. *Erase head*

serving the direction of lay) when the appearance of the head was as in Fig. 21.

A binding over both coils was then laid on to prevent the gap opening, and the whole unit immersed in insulating varnish.

The erase head may well be made in precisely the same way as for the record/playback head substituting stalloy (from old transformer laminations) for the mu-metal, and deleting the annealing process. Actually, for this recorder, a very simple erase-head core was made, using a $2\frac{1}{2}$ in. long strip of Stalloy $\frac{5}{16}$ in. wide bent into a circle.

The ends were filed to a neat butt-joint, and after insulating the ring 140 turns of 28-g. wire were put on toroidally, winding through the gap. The inner ends of the ring were then soldered against the face of a mounting bracket, and tightly butted against a piece of 5 thou. brass shim which was afterwards filed and stoned down to the level of the curved face. Fig. 22 shows the completed appearance.

Adjustment

When the various assemblies were complete the power pack and amplifier were first bench tested, then after fitting to the case, together with the speaker, the input transformer was sited in a hum-free position and brackets made to support it at the angle found suitable.

The deck was then lowered into place after connecting mains, erase and head leads, the switch coupling to **S1** and **S2** "picking up" as the deck fitted home.

With the control set to playback the hum picked up by the R/P head was then eliminated by the experimental placing of mu-metal screens around the coils and core.

The shape of the screeens is highly critical and would obviously vary between different machines but, roughly, it was found necessary to box in the coils and core completely, except, of course, on the working face which was protected by a screen about $\frac{1}{16}$ in. away. The screening mu-metal was cut from surplus cathode ray tube shields.

The record head was clamped down over the upturned lid of an old screening can (aluminium) and the cut-down can made a suitable cover for the unit, being retained in its inverted lid by friction. A curved slot was cut in top and sides to permit threading the tape.

The erase head was boxed in by a smaller aluminium can cut from an old torch case. Neither can is of course functional, merely neatening the appearance of the heads.

With the main sources of hum eliminated (or at least reduced to an acceptable degree), the bias rejector circuit condenser was adjusted as previously described and the first test recordings made. The optimum bias (roughly maximum) was determined by trial and error and also, for future reference, the minimum point at which acceptable quality could be obtained.

A second series of recordings were made to determine how much power could be handled before distortion occurred and the level below which it was inadvisable to drop because of background noise; on the basis of this information the meter resistor was adjusted, and it was arranged that an "average" signal should show about 1/3 full scale reading, the peaks being accommodated by a maximum indication.

Finally, the phone resistor was adjusted to give comfortable headphone strength within the above limits.

The Use of the Recorder

It is highly desirable, to eliminate sundry background noises as well as to promote safety, that the recorder should be earthed via a three-core cable.

To make a recording, the amplifier is switched on and a reel of tape placed upon (but not locked to) the rewind spindle. The tape is then correctly threaded, and started on the right hand (empty) reel placed upon, and locked to, the take-up shaft. The control, previously at "Rewind," is then set to "Record," and the microphone plugged in.

With top and bass controls in a medium position the gain should then be adjusted until the meter reads a correct output; during most speech and music the needle will flicker violently, of course, and some experience is required in interpreting the reading, though this is soon acquired. The recording is then simply started and terminated by the motor switch (a press-on-press-off variety) which being on the front panel permits operation with the lid closed. This type of switch was chosen because it may be simply operated by a solenoid, for remote control from the microphone position.

When the recording is finished the tape is released from the guides, heads and capstan and allowed to pass directly between the spools. The catch on the Rewind reel is then applied and the take-up catch lifted; on pressing the motor switch the tape is rewound at a fair speed—about $1\frac{1}{2}$ minutes are required to wind a 15 min. reel. During rewinding the take-up spool is braked with the finger to assist the tape in winding evenly and at the end is stopped just before switching-off the rewind motor, to prevent overrunning and tangles.

If the tape breaks it is simply joined by cellotape, the ends of the tape being scarph-jointed at about 45 deg., and the cellotape applied to the back (shiny) side. This method of joining is also useful in editing recordings, for which purpose the dull side may be marked with a white chinagraph pencil.

To playback a recording, the tape is arranged as for "Record" and the control turned to "Playback" which follows as soon as the motor switch is depressed. The bass and treble are then adjusted to taste.

When recording the human voice the microphone is best placed about 2 ft. away from the speaker and with the diaphragm horizontally, i.e. at right-angles to the incident sound. This arrangement is very suitable for a number of speakers as the microphone does not then favour anyone, if they are placed around it at the same radius. The microphone should not be placed nearer than 8 ft. or so from a piano, however, and suitable distances for other sources of sound are soon found by experiment. A room for recording should have a low reverberation period, i.e., little echo, and failing any special arrangement the use of a bedroom is found to be best in view of the

quantity of soft furnishings generally present.

The balance between various sources of sound is best appreciated by listening over the monitoring phones during recording, and these are of course essential if using a remote microphone (e.g. with the recorder in the house and the microphone in the open air recording bird song).

The recorder described was designed for use with a commercial crystal microphone costing about 6 guineas, but very good results on speech at least, have been obtained with a small deaf-aid crystal insert, DA1, which costs 25 shillings. This was slung on rubber bands inside a perforated case lined with silk as indicated in Fig. 23. The socket at the base receives a plug on the end of a single-core screened lead, and the mounting

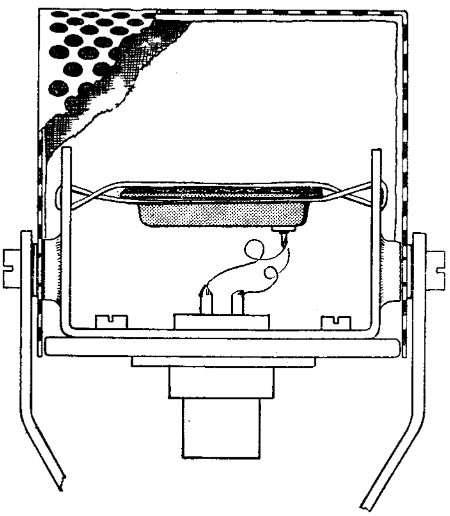


Fig. 23

fork is tapped ¼in. Whit. (not shown in the drawing) by which it may be attached to either a table or floor stand or, preferably, hung from a line across two picture rails.

Recordings may be copied from discs by coupling the input socket of the recorder to a high impedance pick-up. Similarly the output from the detector of a radio may be tapped to record from a radio programme. If a radiogram is available it is very convenient to fit a socket at the back which taps off a signal from the detector-valve anode. A simple link of screened wire terminating in two plugs is then required to connect radiogram and recorder, and one may copy whatever programme is being used by the radiogram, either discs or radio. Such a link has been made for the recorder described, and incorporates in the lead a simple resistance network by means of which the input is reduced to the required level; the recorder first stage would otherwise be hopelessly overloaded.

Recordings may also be superimposed. The first one is made normally, though using as much volume as may be practicable since a certain amount of erasure takes place during the second recording due to the bias frequency.

After rewinding the tape, the permanent magnet is unclipped from the deck and the bias control turned down from its normal, optimum, position to the minimum found desirable in tests.

With the erase switched off the second recording may be made, using a lower setting of the volume control, as found by experiment.

This technique is very useful in such requirements as recording a commentary on top of a musical background for a documentary film, and a little practice soon indicates the correct settings.

Conclusion

The recorder as described was built at a total cost of less than £20 including the DA1 microphone, and had government surplus components been used in *all* suitable positions the cost would have been less. The entertainment value has, I am sure, already exceeded this figure, and the apparatus has the virtue of being appreciated by one's non-technical friends, a happy fate not always applicable to purely "modelling" pursuits. It is not intended to suggest that the recorder described is the final, or only, answer to the particular problems involved, but it does work well and is considerably smaller than commercial machines performing the same function.

Finally, the photographs included with this article were taken during various stages in development and show one or two small differences from the drawings. The latter correspond with the apparatus as completed.

Marine Models

(*Continued from page* 755)

side of the vessel, and one presumes that the model is run on a light line on a circular course. It would be interesting to know what speed she can achieve, incidentally—the boat is very light and should be pretty fast.

There were, of course, many other marine models at the exhibition, but it is impossible to deal with any more in the space at my disposal, unfortunately. As with other sections, all one can do is to pick out and describe a few of the outstanding ones, and apologise to the builders of the others—at the same time thanking them for the pleasure they have given to so many people by exhibiting!

*The Allchin "M.E." Traction Engine

to $1\frac{1}{2}$-in. Scale

by W. J. Hughes

A POINT that strikes one forcibly about many model traction-engines is that the thickness of the hornplates is very much overscale. This may be necessary where copper is used—that is, where the hornplates actually form part of the boiler, as in the prototype—but where, as in our case, separate steel hornplates are attached to the sides of the firebox, it is entirely unnecessary, in my opinion.

For example, in the case of the big Allchin, the hornplates are only $\frac{5}{8}$ in. thick. But not only are they rigidly braced by forming part of the boiler itself, they are also made into a stout box structure by the front plate and the spectacle plate. These are riveted to pieces of steel angle, which in turn are riveted to the hornplates; and at the bottom edge of the spectacle plate, which is cut out in a curve to clear the firebox top, a piece of curved angle is riveted to both plate and firebox top, or arch-plate.

In addition, owing to the lengths of the bearings, the four shafts themselves help to stiffen the structure, though this is somewhat modified by the fact that rotational clearance has to be allowed for the shafts.

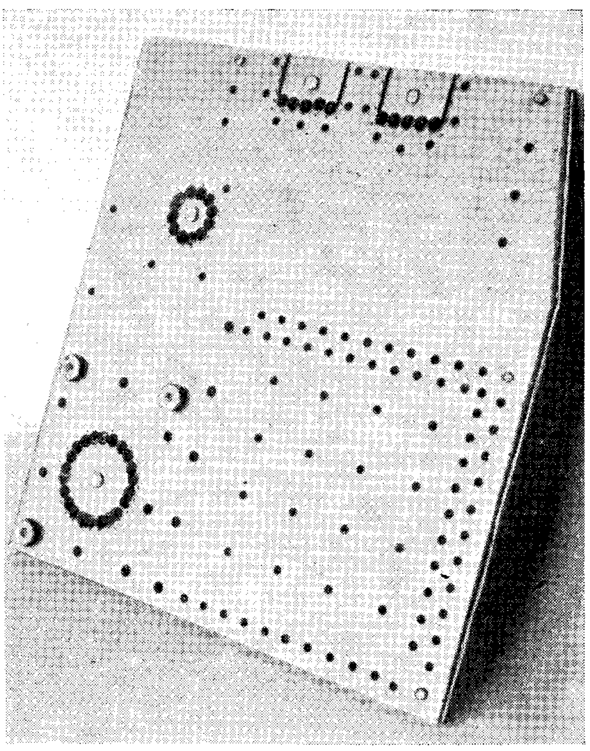


Photo by] [*W. J. Hughes*

Photograph No. 8. The pair of hornplates after setting-out and drilling. Note clamping rivets and screws

The Model Structure

Worked out to *dead* scale, the thickness of the model hornplates would be 5/64 in., but I am specifying 13-g., or 3/32-in., for two or three reasons. In the first place, it cuts out working in sixty-fourths; and secondly it does give an added strength and rigidity, while the 1/64th extra thickness will not be noticed except by the most eagle-eyed of critics.

The box-structure will be carried out in the model as in the prototype, using steel angle riveted to the front and spectacle plates, and to the hornplates. The curved angle will be riveted to the spectacle plate, but we shall have to use screws to fix it to the boiler because we shan't be able to get inside the latter to "hold up" the rivets to make the heads outside. However, the heads of the screws will be concealed by the boiler lagging, so that's all right.

In addition, the model hornplates will be securely fastened to the firebox sides, but at the time of writing I am still experimenting with this, so will say no more just now. I am, however, further strengthening the structure by specifying a plate stay extending between the bottoms of the main (hind axle) bearings.

Setting out the Hornplates

The plates are cut from 13-g. mild-steel, black or bright, and, of course, they should be flat before setting-out is commenced. If bright steel is used, you may find when the slots have been cut out for the crankshaft and second shaft, that slight distortion takes place, but it is nothing to worry about. That happened to mine, but a few judicious taps with a $\frac{1}{2}$-lb. hammer soon set the matter right. But that is anticipating.

The setting-out is largely a matter of careful and accurate work with rule, dividers and try-square, of course. At first it is only necessary

*Continued from page 651, "M.E.," May 15, 1952.

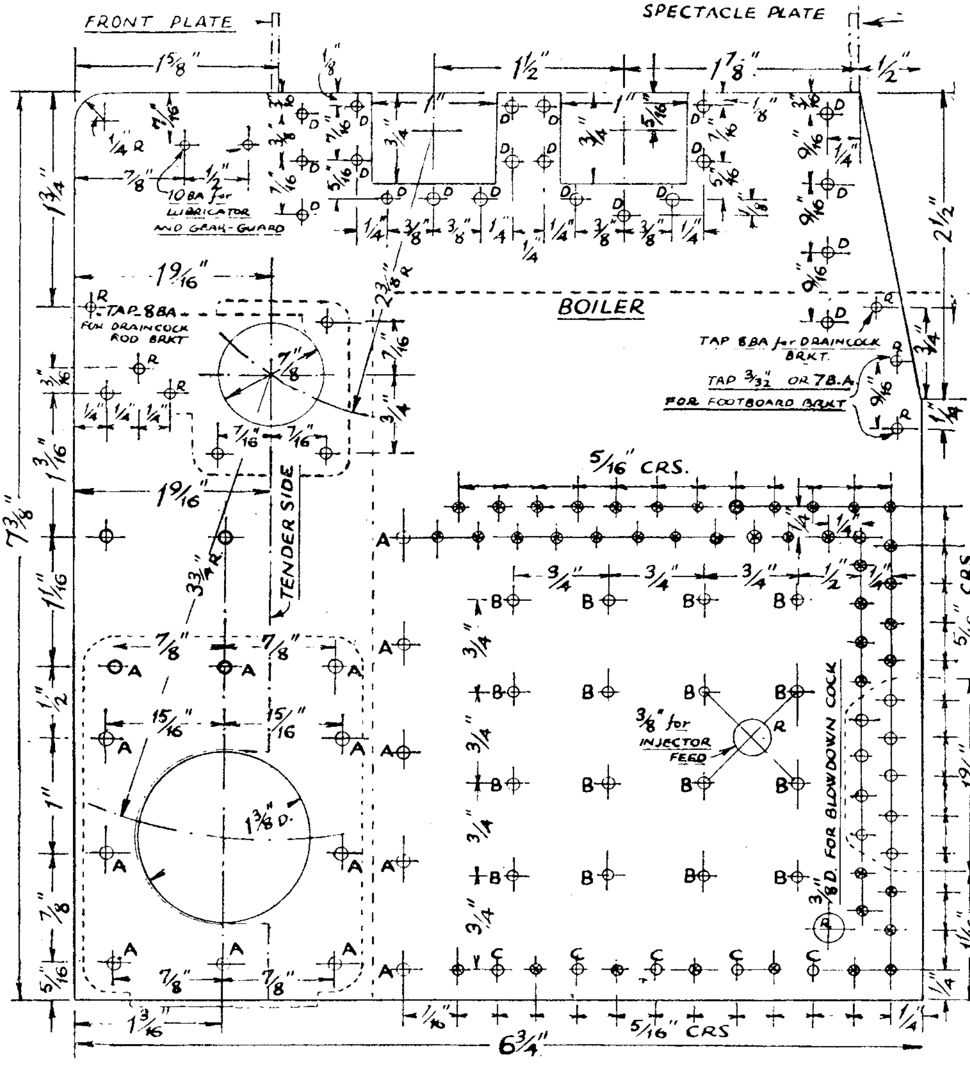
to set out the right-hand plate, since most of the holes can be drilled in the other one by clamping the two together and drilling them simultaneously.

Important Measurements

All measurements are important, of course, but some are more so than others, because the easy-running and efficiency of the machine can be vitally affected by them. In particular, unless the centres of the shafts are accurate, the gearing will either bind or be too slack. And if the crankshaft centres are not correct, this will affect the centres of the connecting-rod and the lining-up of the motion-work of the steam-engine itself.

This is elementary to the experienced model engineer, I know, but the tyro does not always appreciate such detail.

After setting out the outline of the plates, omitting the slots for the crank- and second-shaft brackets, the right-hand one may be filed to shape, taking care not to file over the line in any place. In fact, I prefer at this stage to leave the lines definitely showing. It is good engineering practice to make light centre-pops at intervals—say every ½ in.—along any line to which you have to file. Then when you file almost to the line, and the latter is not too clear owing to "fash," you can still judge from how much of the centre-punch marks is left on the edge as to how much further you still have to file. An automatic

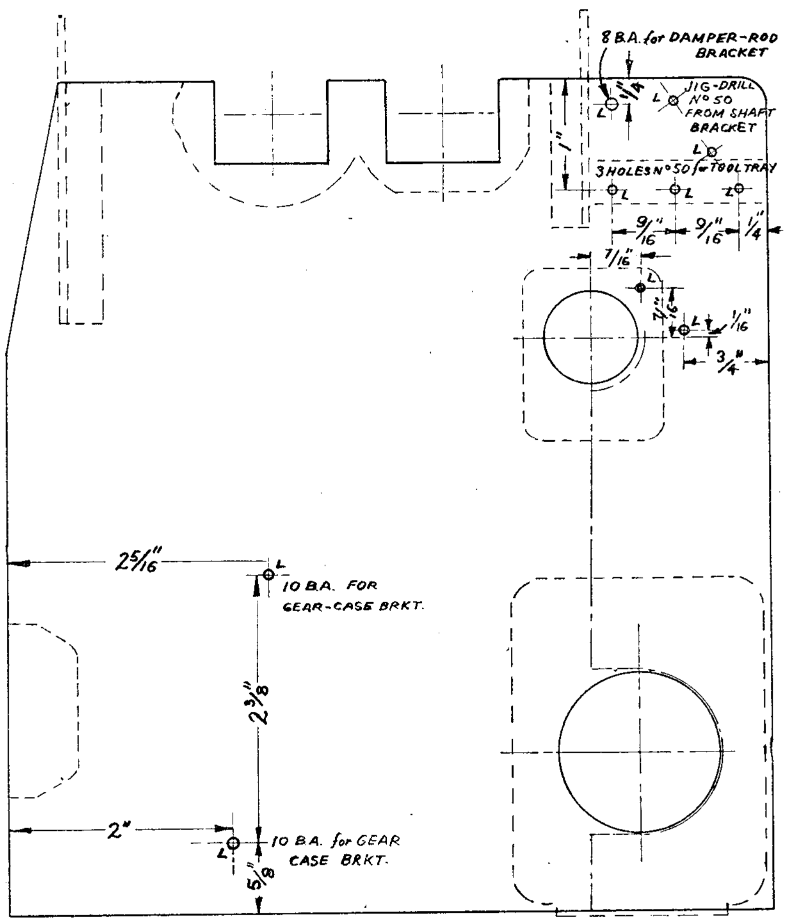


Dimensions and setting-out of the right-hand hornplate. Holes marked "R" should not be set out at this stage

centre-punch is ideal for this job. These punch-marks may be seen clearly on the original of Photograph No. 8, around the bearing slots and holes, and on the front edge of the hornplate, but they may be lost in reproduction.

Setting out the Centres

However, returning to our right-hand hornplate, when filing is complete, set out first the centre of the crankshaft, at $1\frac{7}{8}$ in. from the top of



The left-hand hornplate, showing holes (marked "L") that are exclusive to this plate alone. Other holes are drilled through the right-hand plate : see text

the sloping front edge and $\frac{5}{16}$ in. from the top edge. Centre-pop lightly at this mark. Set the dividers carefully to $1\frac{1}{2}$ in., and set out the centre of the second shaft, also $\frac{5}{16}$ in. from the top edge. Centre-pop this mark, too.

Now scribe a line $1\frac{9}{16}$ in. from the back-edge—it can be marked right to the bottom, as it represents the edge of the overlap of the side of the tender. With dividers set to $2\frac{3}{8}$ in., and one leg at the second shaft centre, describe a small arc to intersect the $1\frac{9}{16}$-in. line. This will give the centre of the third shaft, and can be centre-popped, too. The centre of the hind axle is set out similarly, on a line $1\frac{3}{16}$ in. from the back edge and at a radius of $3\frac{3}{4}$ in. from the third shaft centre.

On the hind axle centre, scribe a circle $1\frac{3}{8}$ in. in diameter, and on the third shaft centre, another one but $\frac{7}{8}$ in. diameter. These are to take the spigots which you will turn on the respective bearing brackets.

Next, set out the slots 1 in. wide and $\frac{3}{4}$ in. deep for the bearing-brackets of the first and second shafts. These lines, and the two circles, should be lightly centre-popped at distances about $\frac{3}{16}$ in. apart as a guide to the filing operation which is to follow.

The rest of the setting-out is pretty straightforward, and need not be detailed. You will notice that on the drawing many of the holes are labelled "A," "B," "C," "D," and "R," and some are marked with a cross. These references are for use in the drilling, and can be ignored for the time being, all the positions being centre-popped as usual. At this stage, however, do *not* set out the positions marked "R," because these are on the right-hand hornplate only. If you set them out now and centre-pop them, you'll be likely to drill them right through *both* plates when they're clamped together for drilling!

Filing to Size

The hornplates may now be fixed together for filing to finished size, and for drilling. If you look at the photograph, you'll see that I used both rivets and screws for this ; two rivets along the top, two at the front, and one through each of the four shaft centres, with three $\frac{1}{8}$-in. screws and nuts through hind-axle bearing holes.

Drill these eleven holes in the right-hand plate, those for the rivets being 3/32 in. diameter, and for the screws No. 30. Then clamp the plates securely together with tool-makers' clamps or small G-cramps, and drill the holes right through both. As each hole is drilled, however, insert

the rivet or screw—the rivets need not be headed *too* tight, or the plate will be bruised.

With the clamps removed, the plates may be filed to the finished sizes, a constant check being made with the try-square on the edges.

Following this, the remainder of the holes may be drilled. Those marked "A" are No. 30, and "B," "C," and "D" are 3/32 in. Those marked with a cross, and the nine unmarked holes in the front two rows (where the steerage brackets fit) are also drilled 3/32 in. diameter. The three remaining holes, for the third shaft bearing bracket are drilled No. 40.

Cutting Bearing Slots and Holes

The easiest way to cut out the slots and holes for the bearings is the old one of drilling holes near the edge of the waste. For the slots it is quicker to drill a single row at the bottom—five of $\frac{3}{16}$ in. diameter just do nicely—and then to saw down the sides, as shown in Photograph No. 8. In the photograph, too, you will see the circles of holes for the third and fourth shaft bearings.

The holes and the saw-cuts should come inside the lines, of course. Tip: drill the holes undersize at first, and then drill the alternate ones in the row full size, before enlarging the others. This helps to prevent the drilling wandering.

Waste in the slots can then be broken out with a pair of pliers, and in the holes with a light tap or two from a ball-pane hammer, with the plates suitably supported over a bush or something similar.

The holes may now be filed out to the line with a half-round file, with constant checking with a small try-square to ensure accuracy. This is extremely important; if it is not done carefully, the bearings when fitted will be out of line and will bind on the shaft or shafts.

The slots, however, should be cleaned up, but *not* finished to the lines, as they will require individual fitting to their respective bearing-brackets. The latter are to have further slots milled or filed in them later, so lining-up of the hornplate slots is not quite so vital, but even so for the sake of pride of craftsmanship it should be done as accurately as possible. Don't you agree?

(*To be continued*)

For the Bookshelf

Photo Electric Cells, by P. T. Smith. (London: Percival Marshall & Co. Ltd.) 78 pages, size 4¾ in. by 7¼ in. Illustrated. Price 5s. net.

This is a most useful little handbook dealing with a subject the importance and significance of which are increasing daily. The book is essentially descriptive and points out the astonishing variety of uses to which light-cells are already applied in our daily lives. Even in this enlightened age, we doubt if many people are aware of the extent to which the light-cell influences their everyday movements.

Mr. Smith begins by describing different kinds of light-cell in use, and follows up with seven brief chapters, each devoted to applications of the cell. The three final chapters refer to later developments and more or less specialised types of cell and their uses.

The illustrations are mostly circuit diagrams, but line drawings and photo-reproductions support a lucid and interesting text.

Teach Yourself Modelcraft, by H. S. Coleman. (London: English Universities Press Ltd.) 180 pages, size 4½ in. by 7¼ in. Price 6s. net.

This is the latest addition to the "Teach Yourself" series of books issued by English Universities Press Ltd., and we find it interesting, persuasive and informative. It does not treat exclusively of model engineering, but covers the whole field of model making. It is divided into two parts, the first of which is comprised of four chapters discussing, respectively, the Why, When, Where and How of the subject. The second part is devoted to practical guidance in the making of many different kinds of models.

Obviously, in a book of this nature, precise and detailed instructions cannot be given; but a great deal of sound practical advice, supported by admirable illustrations in line and halftone, is to be found in its pages. The main purpose throughout is to fascinate the reader and to stimulate a desire to make a start in a worthwhile hobby; and we think Mr. Coleman achieves a large measure of success in his endeavours.

The Craft of the Metal Worker, by Robert S. Duddle. (London: The Technical Press Ltd.) Price 17s. 6d. net.

Mr. Duddle has done a good job in his compilation of *The Craft of the Metal Worker*, an exceedingly difficult subject to cover in one volume, by virtue of its wide application. This book, however, should not be classified as a text book, but rather, as was intended by the author, as an introductory work describing the principal processes and their underlying principles.

Starting with an introduction covering the historical aspects, the reader is taken through the various branches of the craft in the ensuing chapters to the accompaniment of line drawings, which are mostly of the three-dimensional, semi-pictorial variety. These are very easy to follow and should widen the scope of the book to include casual or non-technical readers as well as the beginner, although it should undoubtedly be read by all who are interested in metal work.

A comprehensive list of reference book titles is included so that readers may further pursue those branches in which their main interests lie.

Model Power Boat News

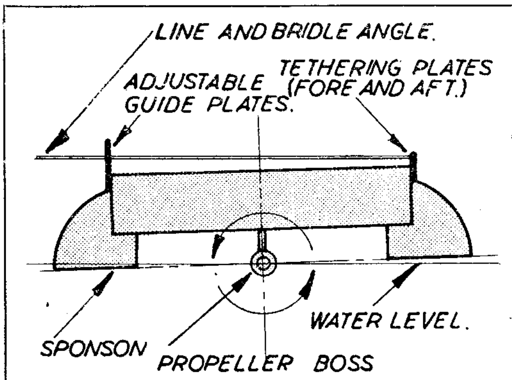
Tethering Problems

by "Meridian"

THE tethering of hydroplanes for running on the circular course is yet another one of those problems confronting the newcomer to speed boat work, simply because there is little written information available.

This state of affairs is hardly surprising since each boat provides a separate problem, and the time-honoured method of trial and error is followed in practically every case. A few notes on some of the basic points, however, may be of help to prospective speed boat men.

The two-point tethering arrangement or "bridle" has now completely ousted the old single-point method and has been in use for several years. It is largely responsible for the increase in the maximum speeds attained. With the two-point method, advantage can be taken of the semi-submerged or "surface" propeller which is not possible with the single-point tethering.



Sketch showing rear view of hull on circular course, banking inwards

It should not be assumed, however, that boats will only run "surfacing" *because* of the circular course—on the contrary, there is ample evidence to show that boats will run on a free course using this form of propulsion, although impractical at ordinary boating lakes due to the high speeds attained, and the impossibility of control in restricted space.

The standard bridle is 48 in. from the centre of the boat to the point of line attachment, and referring to the M.P.B.A. rules on the subject it should be noted that "one, two or more points" can be used when attaching the bridle to the boat. Other points are: "The bridle . . . must be flexibly attached to the hull so that it does not constitute an artificial stabiliser," and "must have a breaking strain not less than that of the line."

Where Bowden wire cable is used, care must be taken not to kink the wire where it joins the fittings. An excellent description of wire bridle fittings was given recently in THE MODEL ENGINEER (March 6th, 1952), and, although referring to model cars, it is equally applicable to boat fittings.

Hook fittings are generally adjustable for position on the bridle, and this is easy to arrange where Bowden wire is used. Some well-known competitors use instead of wire several lengths of braided flax line which is plaited together; this gives a certain amount of spring to the bridle and may help to prevent a capsize when a "snatch" occurs.

The fittings for attaching the bridle to the hull require to be substantial, and it is a good feature to have some reinforcement right to the other side of the hull. Without this precaution it is not unknown when a bad snatch occurs, for a large chunk of the hull to be ripped clean away! In one case the complete side of a well-known boat was left attached to the line, while the rest of the boat careered down the lake, until the concrete side stopped further progress. *That* hull was a write-off!

There is a growing trend to arrange the tethering so that the pull of the line helps to bank the boat inward, i.e. so that the outer plane rides clear of the water. This method may tend to offend the purist, but it has to be admitted that full-size racing boats also bank inward when cornering at speed; in fact, they would probably roll over if they did not. Other examples are, of course, aircraft and motor-cycles. The radius of the normal circular course (47 ft. 9¼ in.) is small when speeds of over 60 m.p.h. are considered, and it may be argued that banking is a logical step for racing in this fashion. It should be noted, however, that some exponents bank their boats in the opposite direction, with the inner plane lifting!

Advantages gained by banking are: (1) Steadier running in disturbed water; (2) Less tendency to flip, as air spills more readily from the underside of the hull; (3) Engine has better chance of developing full power, as the propeller is less likely to jump clear of the water when a "bumpy patch" is met.

If perfectly calm conditions were available it is possible that arranging the boat to run with both sponsons in contact with the water might result in *faster* speeds, since when banked the

inner sponson tends to dig in, and greater friction is caused.

In this country calm conditions are a rarity and hydroplanes run under adverse conditions. In this connection it should be remembered that "full-size" record attempts are sometimes held up for weeks while waiting for calm water.

In order to make a hydroplane bank inwards a high tethering position is usual. A good way of achieving this and at the same time avoiding the necessity of reinforcing struts across the hull is shown in the sketch. The bridle is fixed to the outer side of the hull; on the inner side the bridle cable or line passes through a hole in a supporting plate, the height of which governs the amount that the boat will bank.

If flax line is used for the bridle, a rubber grommet may be fitted in the hole to avoid the possibility of fraying at this point.

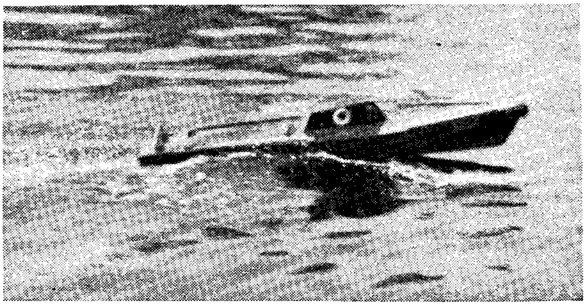
The actual tethering positions are fore and aft of the boat at or near the extremities, but one or two boats are tethered a little away from each end—*Sparky II* is a good example of this.

Positioning of the hook attachment on the bridle is a matter for trial, but most hook positions appear to be more or less opposite the engine. It is rare that the two arms of the bridle are exactly the same length.

Trends of Design

Mr. T. W. Liddell's interesting letter in the issue for May 8th raises some interesting points which it is hoped to discuss in this column at a later date. In the meantime, a personal opinion concerning the present appearance of hydroplanes, is that they are a considerable improvement on the almost universal kipper-box design of pre-war days!

An item of news that will please Mr. Liddell and other steam enthusiasts is that Mr. B. Pilliner (Southampton) has been achieving some amazing performances with his Class "A" flash-steamer. Speeds of over 60 m.p.h. were recorded recently, and one run ended with a "flip" at nearly 70 m.p.h. There is no doubt that flash steam excercises a tremendous fascination, and it may well be that up to now only a small part of the possible power available has been used. The big snag is the experimental time necessary for the successful development of a flash boat—not to mention the hard work.



Mr. S. J. Thomas' "Rose"

Regatta Season Commences

The first inter-club regatta of the 1952 season was held recently at Brockwell Park when the South Eastern Association promoted an event for straight running and radio-control boats.

Brockwell Park is rapidly getting a reputation for rainy regattas, as this one is about the 3rd in succession to suffer the handicap of a downpour. Nevertheless, all events were run and a good number of boats, including several new efforts, made an appearance.

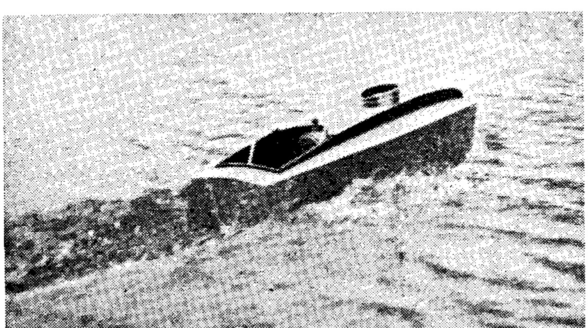
The Blackheath club were well on form, winning all three places in the Nomination event and two in the Steering. A new launch by Mr. Chandler (Southend) made a fine debut by winning second place in the latter event. This boat is a straight-runner and will provide keen competition at future regattas.

An Experimental Event

The radio-control event was in the nature of an experiment and some four entries competed.

A large number of buoys were marked alternately with red and green flags. Boats were required to pass to the right of the green ones and left of the red. Teething troubles were apparent in some boats, and one disadvantage is the fact that only one transmitter can be operated at a time. This prevents adjustments and checking to the other boats when one is operating.

Mr. Wayne (Southend) with a fine battle-cruiser was the successful competitor scoring 50 points, Mr. Petch (Bromley) also scored 50, but the judges awarded 1st place to Mr. Wayne for the better performance in negotiating the course. Mr. Wayne's boat is electrically driven and besides steering, can be made to reverse, ring bells, klaxons, etc.!

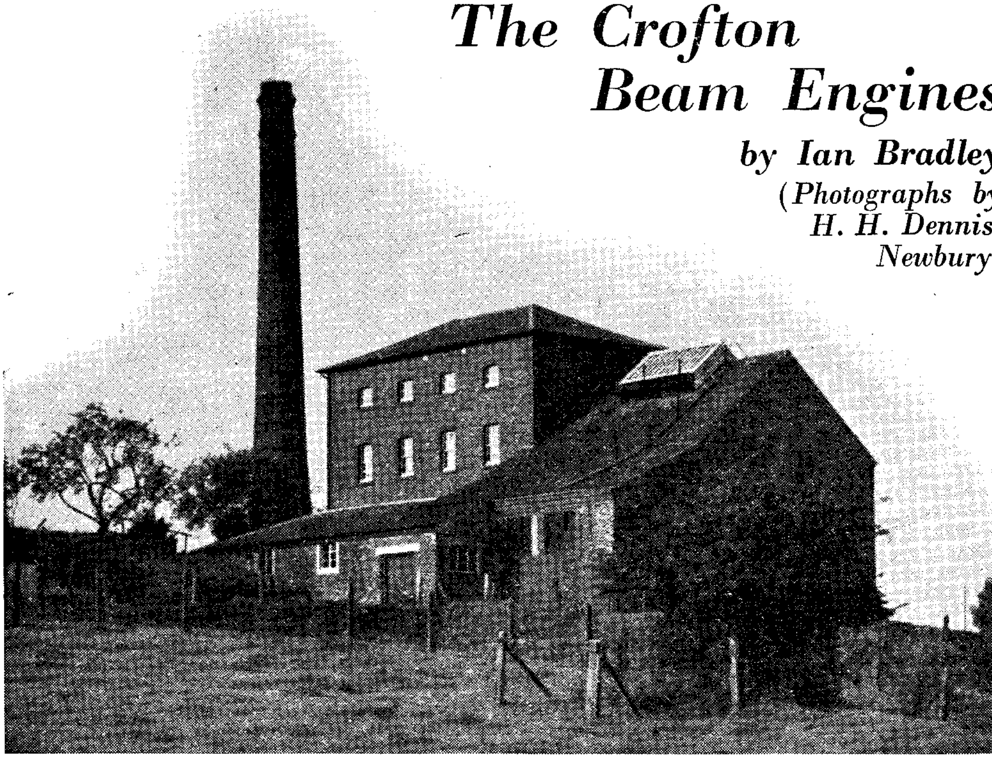


Left—Photograph shows Mr. Raymon's "Yvette"

The Crofton Beam Engines

by Ian Bradley

(Photographs by H. H. Dennis, Newbury)



The Crofton waterworks

THE pumping station situated close to the main G.W.R. line at Crofton is of more than passing interest to lovers of the steam engine, for it houses a pair of beam engines in impeccable condition, and one of them would appear to be, without any doubt, the oldest surviving engine designed and made by James Watt and still remaining in daily service. There appears to be some doubt as to whether the engines are of the single-acting or double-acting type. The engineer of the Inland Waterways Executive tells me that he is not sure, and that neither are the Newcomen Society certain on this point.

However, it seems almost certain that they must be double-acting condensing engines, for Dr. Lardner in his book *The Steam Engine*, published in 1851, says that Watt used chains only to couple the piston to the beam of a single-acting engine and that Watt's parallel motion, fitted to the Crofton engines, was designed to deal with conditions when thrust was applied to the beam in both directions.

Crofton is a small village close to Great Bedwyn, in Wiltshire, situated at the point where the Kennet & Avon Canal reaches its highest level between London and Bristol. In order to maintain working conditions and to keep the canal from running dry, water in considerable quantities must be pumped into the canal at the summit level, as it is called.

The Kennet & Avon Canal appears to have been the work of James Rennie, and a map of the projected waterway shows that the original intention was to drive a tunnel some three miles long starting near the present pumping station at Crofton and extending westward to Savernake, to avoid raising the canal to the level it now occupies.

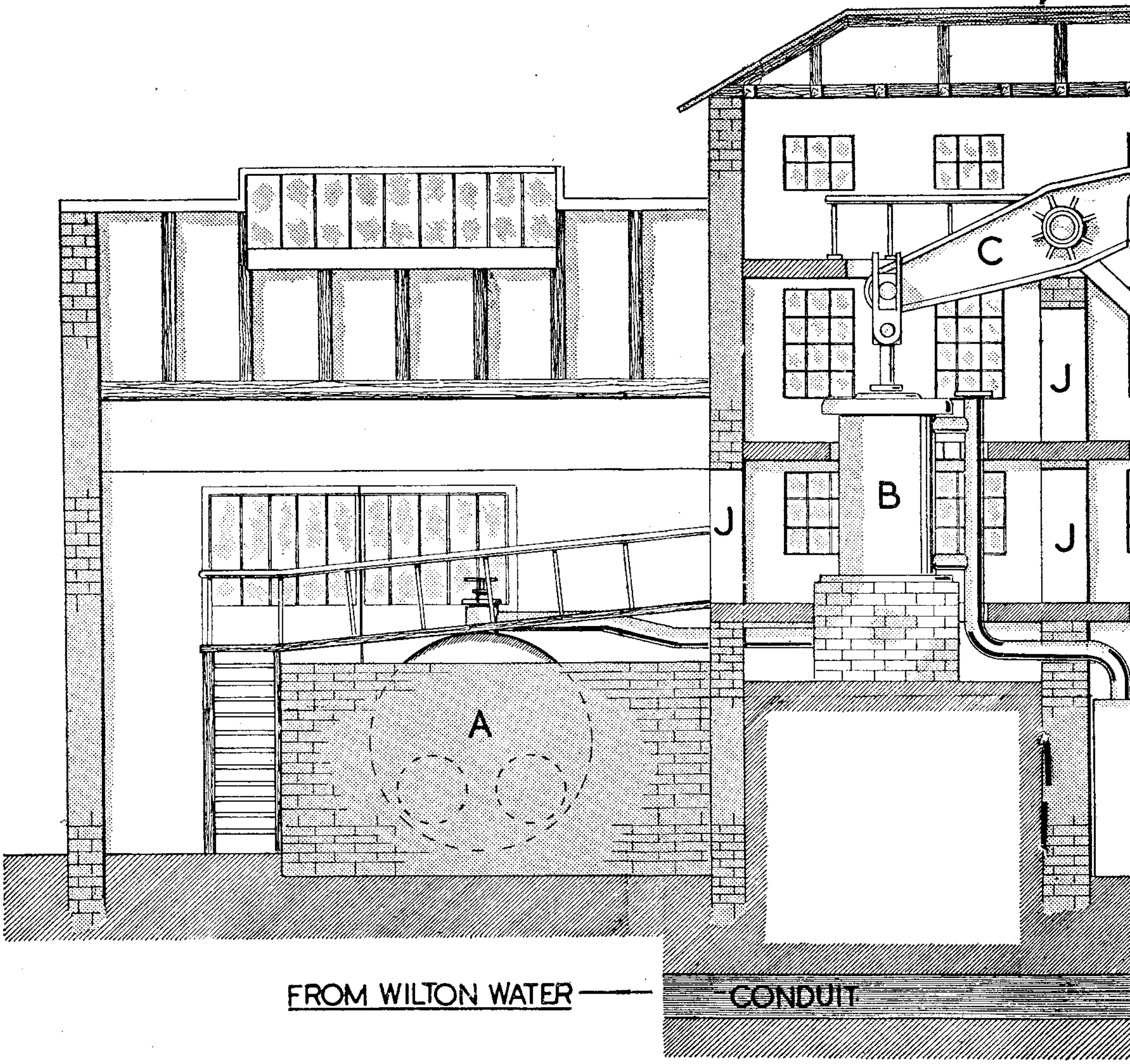
However, as difficulties in the execution of this scheme were anticipated and as ample water supplies could be drawn locally from a natural reservoir known as Wilton Water, it was decided to raise the canal bed, build 600 yds. of tunnel close to what is now Savernake Station and install pumping machinery at Crofton.

Work on the pump house seems to have begun in about 1800, but the buildings did not then much resemble the present-day structure for there was no boiler house, the boilers, all five of them, being in the open. Nor was there a brick chimney. The original stack was of iron and was placed at the end of what is now the boiler house. It is not, perhaps, quite accurate to describe the iron stack as the first to be erected on the site, because, as was so often the case in those days, many of the castings for large engines

were made on the spot. Therefore, some form of chimney for the foundry was essential. When many of the parts of the Crofton engines are examined it will be seen that the task of transporting them over a long distance would have been formidable, and that casting and machining these components on the spot offered a more practical solution. Several pieces of pig-iron that have been found in the undergrowth bear witness to the adoption of this method.

Wilton Water, the natural reservoir which supplies the pumps, is on the opposite side of the main G.W.R. line some 200-300 yds. distant from the works. The total lift from the reservoir to the canal feeder is 40 ft. Two engines are housed in the building, and both engines are beam engines without flywheels. The engine house has three floors and a 40-ft. well containing the pumps; the hot well and condensing mechanism is set at the top of this well.

On the ground floor, that is the floor on a level with the canal feeder, and immediately within the entrance doors, the tops of the pumps are to be seen with their pump-rods reaching up through the ceiling to the links of the parallel motion in the room above. Passing through a passage-way in the thick cross wall that supports the beams of the engines, access is obtained to the controls. It is from this point that both engines are driven. A passage between the cylinders leads to a door in the end wall. This door opens into the boiler room, and the stokehold is reached



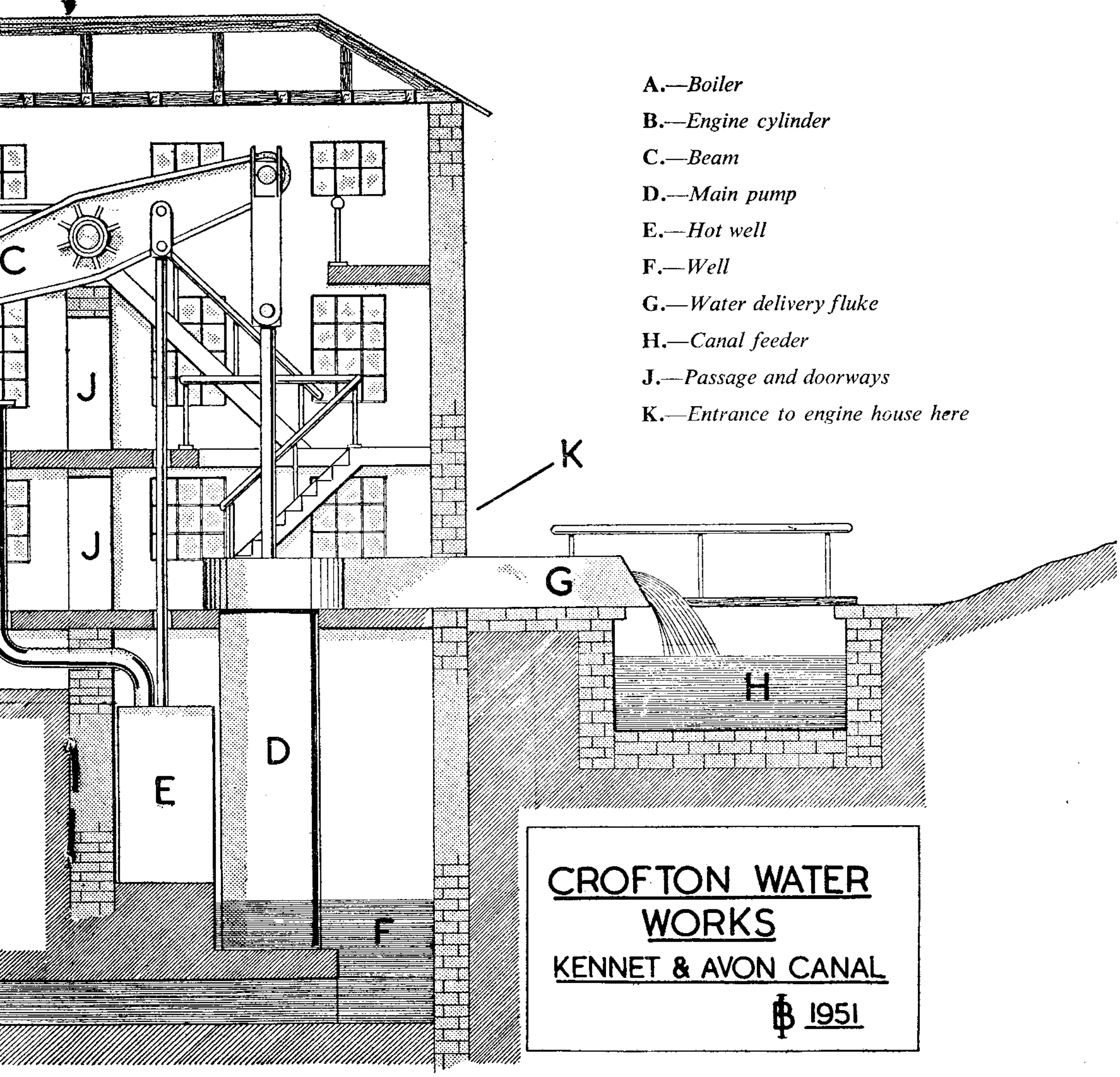
Sectional elevation of Crofto

by crossing the boiler and descending a flight of stairs. The boiler room is of large size, is well lit, and there is plenty of space in which to move about. The boilers are set at right-angles to each other.

On the second floor of the engine room, on ascending the central staircase from the ground floor, the linkage for the parallel motion may be seen. Passing through a passage-way in the central wall the cylinder tops and the upper valve-gear are reached. For those who admire perfect mechanical motion, this is the place from which to watch the engines when they are running. From here may be seen the ends of the beam as it appears through the ceiling of the top floor, and the linkage that couples it to the piston-rod, as well as the various pump-rods and valve operating-rods.

A climb up a further staircase brings the visitor to the top floor and to the massive beams of the engines themselves. On this floor also will be found the winches, one at each end of each beam, that are used when the pumps or engine pistons have to be withdrawn from their cylinders for servicing. This does not seem a frequent occurrence, and the last recorded occasion when the piston of the larger engine was lifted is over 60 years ago.

It is hoped that the short description given above will convey something of the disposition of the engines within the engine house. I have made many enquiries to try to discover if there



A.—*Boiler*
B.—*Engine cylinder*
C.—*Beam*
D.—*Main pump*
E.—*Hot well*
F.—*Well*
G.—*Water delivery fluke*
H.—*Canal feeder*
J.—*Passage and doorways*
K.—*Entrance to engine house here*

[...]vation of Crofton waterworks

is in existence any authentic drawing of the complete installation. It would appear, however, that no such drawing is to be found. I have been informed by Mr. D[illegible]son of the Inland Waterways Executive, that there is no illustration of the plant amongst the records held by them at Gloucester.

An attempt has therefore been made at producing a diagrammatic representation. This drawing has been prepared without making any measurements, and is based upon photographs and notes taken on several visits to the works. Obviously, it has been necessary to omit details such as the parallel motion, the valve-gear and other complex detail. To include them in a small scale drawing would have been impossible. Nevertheless, the illustration will help the reader to visualise the arrangement of this interesting installation. So far as I am aware, it is the only drawing that has been made since Messrs. Boulton and Watt laid down the original designs.

If anyone contemplates making a model of the Crofton works, and what an interesting model that would be, I would suggest that my drawing should be used for general guidance only. The whole plant will need to be correctly measured, an operation that will need two people if it is to be done accurately.

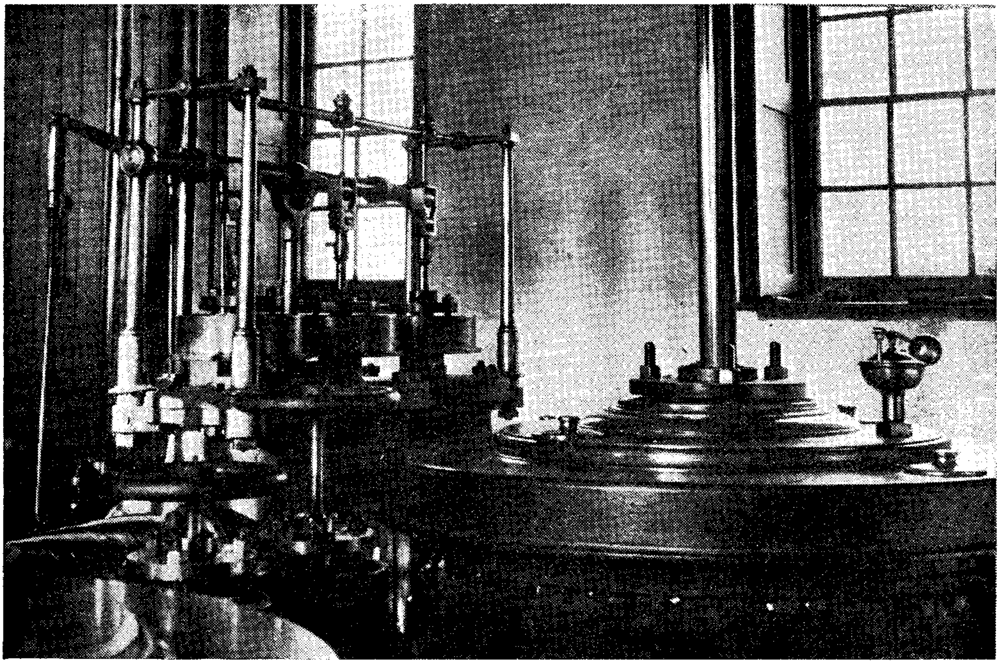
However, it is time that the engines were examined in further detail. The larger of the two engines, hereinafter referred to as No. 1 engine, has a cylinder 42 in. bore × 8 ft. stroke and was installed in 1802, having been made by James Watt, in the first instance, for pumping St. Katherine's Dock, London. This engine has Watt's parallel motion and drives a bucket-type pump.

The cylinder of this engine is cast in two parts bolted together and machined, and is provided with the steam jacket, a feature of Watt's designs. This jacket, however, is not now in use. In addition to a series of rag-bolts which serve to hold the base of the cylinder to the brickwork supporting it, a pair of dogs, as illustrated in the sketch (Fig. 1), are used to assist in maintaining rigidity. The dogs on the opposite side of the cylinder are actually longer, as they have to straddle the steam pipe, and are held down by a pair of nuts.

The piston has a diameter of 42 in. and is not fitted with rings, but is packed with hemp. As has already been mentioned, the piston has not been lifted for sixty years. A report to headquarters at Devizes mentions repacking the piston on January 19th, 1850 and again on October 7th, 1856. It would seem, therefore, that the work on that occasion was not carried out with the skill or success that has attended subsequent operations of this nature.

The valve-gear follows the usual Watt pattern, but it seems that some modifications may have been carried out since the gear was originally made.

The working pressure of the engine is 20 p.s.i. and, under normal conditions, a vacuum of 25 in. is maintained.



James Watt engine—cylinder cover and valve-gear

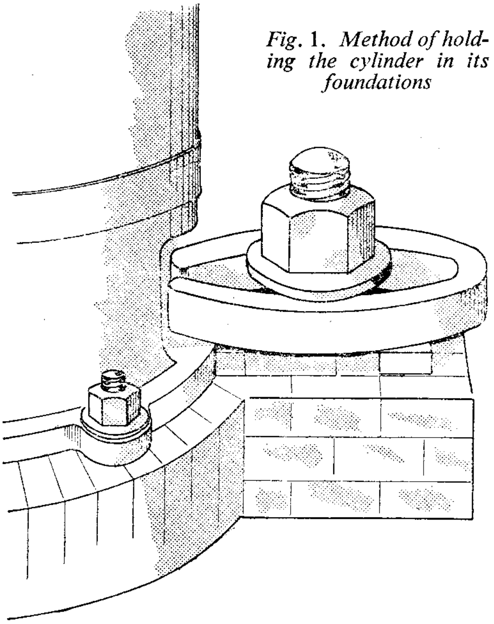


Fig. 1. Method of holding the cylinder in its foundations

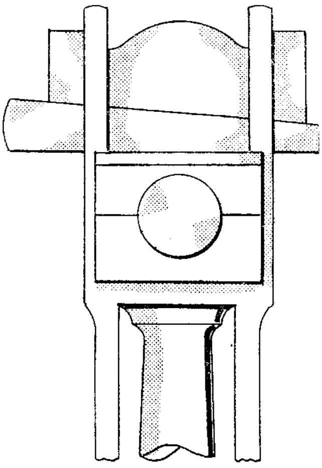


Fig. 3. Bearings of the piston-rod linkage, No. 1 engine

The beam, a double one, is staked on to its shaft in the manner illustrated in Fig. 2. The weight of the beam is said to approach nine tons, so there is little wonder that this part was one of those cast on the site.

The beam is 25 ft. 6 in. long and its maximum depth is 48 in. The centres of the piston and pump-rods are 24 ft. apart.

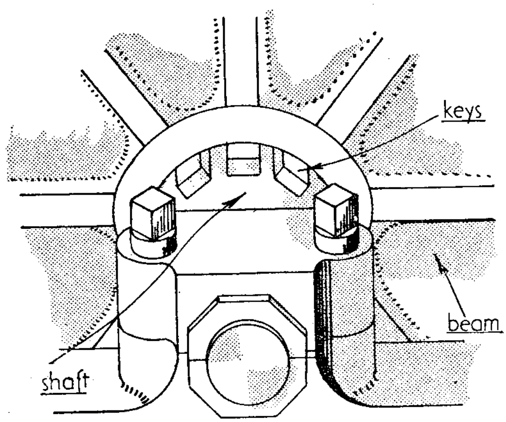


Fig. 2. Illustrating the manner in which the beam is staked on to the shaft

Anyone interested in machine details will find much of interest in these beautifully made engines. The great cast-iron links, with their lattice work design, coupling the pump-rod to the beam and the method used to secure and adjust the bearings of the piston-rod linkage at the opposite end of the beam, illustrated in Fig. 3, are examples of the many fine machine parts to be found at Crofton.

The cylinder is fitted with an ornamental cast-iron cover that is machined all over. Mounted on top of this cover is the cylinder lubricator, known to the irreverent as "Aladdin's Lamp." It screwed directly into the cylinder-head, and is polished all over. The oil container is fitted with a valve weighted so that it does not open when steam is admitted to the cylinder. Oil is admitted on the upstroke of the engine, that is when there is a vacuum above the piston; to do so, the weight is lifted by hand.

The second engine at Crofton is not that originally installed there in 1806. Details of the first engine are very obscure; it was known as the "combined engine" and is so described in the report sheets sent regularly to Devizes even as late as 1890. It is thought that this engine was a Watt compound condensing engine having two cylinders, and some colour is given to this view by the disposition of the foundations and the relatively large amount of space under the present No. 2 engine.

However, whatever the original engine may have been, there is no doubt at all about the present one, for records show it to have been erected in 1847. It was probably built by Harvey's of Hayle, Cornwall. A cast-iron plate, now in use in the boiler room, has Harvey's name and address cast upon it together with the date 1846. It seems likely that certain parts of the old engine were used and probably some elements of the valve-gear; the original beam was not retained for the records show that this part was still on stock at the Crofton works as late as 1868. The present beam is keyed on to its shaft in a normal manner and not staked, as is the beam for the No. 1 engine.

(To be continued)

"Britannia" in 3½-in. Gauge

by "L.B.S.C."

How to Erect Valve Gear

THE next item on the programme is to assemble and erect the parts of the valve-gear thus far completed ; and here, we are up against the old, old trouble, viz. that Nature refuses to be "scaled." The full-sized engine's valve-gear is held together by hefty pins having large flat heads (eh ? Yes, I've met *that* kind, too !) which are placed on the side of the gear nearest the frame. They are kept from coming out, by collars on the outer end, secured by split taper pins through the lot. Now, while this *could* be reproduced in 3½-in. gauge size, it would only be suitable for a locomotive built to spend its days in a glass case ; something a little more substantial is needed for a hard-working little engine. I am therefore specifying pressed-in. silver-steel pins for those which need not be removed until such time as the engine needs shopping for heavy repairs, and nutted pins for the rest. To preserve neatness of appearance, the pins are shouldered down at each end, screwed and furnished with small nuts which only need be large enough to prevent the pins coming out. The only stress they have to resist, is the infinitesimal side thrust of the pins ; so pins of $\frac{1}{8}$ in. diameter can be reduced to 3/32 in. at the ends, and screwed 3/32 in. × 48 (Whitworth size) or a shade under 3/32 in., and screwed 8-B.A. Note—where the pins go through forked joints, they should be just long enough to enable them to be turned by finger pressure, *when both nuts are hard up against the shoulders.* This obviates any possibility of the forks getting pinched—in the "third programme" sense, I hasten to add ; nothing to do with policemen !—and causing friction in the joints.

First Stage of Assembly

The first job is to assemble up the expansion link, radius rod, and lifting link as a single unit. As the fork of the radius rod has to pass between the trunnion brackets on the expansion link, it is obvious that a flush pin is called for here. Put the die block in the link, any place clear of the bracket, and put the end of the long fork over the lot, so that the holes in the ends of the fork, line up with the hole in the die block. Warning—don't forget that the short fork of the radius rod is offset to meet the combination lever, therefore you'll need one right-hand and one left-hand assembly. As both expansion links are identical, all this entails, is to see that the offsets are on the opposite sides of the link, before squeezing in the pins. The latter are merely two pieces of $\frac{1}{8}$-in. round silver-steel about $\frac{5}{8}$ in. long, and slightly chamfered at one end, just enough to enter the No. 32 hole in the radius rod a weeny bit.

Being the lucky owner of a powerful little bush and mandrel press (present from the late Bro. Wholesale, for "services rendered") I use that to press in my valve-gear pins, which it does perfectly, in two wags of a dog's tail ; but the bench vice may be used with equal celerity. Take one precaution ; make a short pair of vice-jaw clams from copper, not thinner than $\frac{1}{8}$ in. Any odd bits of sheet copper of requisite thickness will do fine ; they don't have to be the full width of the jaws. Enter the chamfered end of the pin, in the hole in one side of the radius rod fork ; put the lot—expansion link between fork jaws, and die block in line—between the clams in the vice jaws, carefully turn the handle, and squeeze in the pin until the chamfered side is flush with the other side of the radius rod fork. It won't come right through, as the clam prevents it ; but you'll need to press it through, so that the chamfered part may be filed away, leaving full-diameter of the pin in the hole in the fork jaws. Drill a 5/32-in. hole in a bit of 16-gauge brass or copper ; replace the assembly in the vice, with the bit of metal between the radius rod and the vice clam, the hole being opposite the end of the pin. Another slight dose of the squeezing process, imagining yourself to be Chancellor of the Exchequer framing a budget, will force the pin a little farther through. Remove from vice, file the pin both sides flush with the fork, and Bob's your uncle once more.

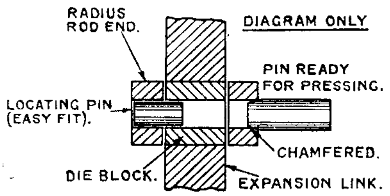
A Lining-up Tip

Experienced readers will, I hope, excuse me for dilating on the above, but my correspondence tells me that there are many new readers building *Britannia*, and they say, please don't forget to detail out specially important points. I do my best to oblige. In that connection, I can imagine some of them saying, how the merry dickens can we tell when the hole in the die block is dead in line with the hole in the end of the radius rod, when the whole issue is in the vice jaws, and we can't see the holes at all ? Simple, my dear Watson, as the great Sherlock would have said. Everything is easy *when you know how* ! The solution of the problem is merely a weeny bit of round steel, only $\frac{1}{8}$ in. long, and an easy push fit in the hole in the radius rod fork. After putting the fork over the expansion link and die block, put this little merchant into the "offside" hole in the radius rod fork, and push it right home, so that it just enters the hole in the die block, and keeps it in line with the hole in the fork. Put the chamfered pin in the hole in the opposite side of the fork, and press home in the vice, as described above, until the two meet. Remove from vice, shake out the little locating merchant,

and finish the pressing as described above. Simple enough, isn't it?

How to Fit the Lifting Links

It should be possible to slide the die blocks up and down the expansion link without any sign of binding or going hard, especially when the radius rod passes the link trunnion brackets. If not, make the necessary easement with a fine file, before proceeding ; you can find it by careful observation of the actual job. Next item is to



How to locate holes in line for pressing in

fit the lifting links to the radius rods, at the next hole in the long fork ; and as this is done in a manner similar to the process described above, there is no need for repetition. The only thing to remember, is not to fit the lifting link to the radius rod upside down—did I hear audible smiles? Well, it is a jolly sight easier than one would imagine, to make that mistake I know a certain party who laughed long and loud when somebody said to him "Did you put the union nuts on the pipe before you silver-soldered the cones?" The laugh was on the other side of his face when he went to erect the pipe, and found that the two nuts were on the wrong way, the tapped ends facing each other! Also, the oil boss at the bottom, with the countersunk hole in it, should be away from the expansion link, and looking toward the front of the engine.

Erecting the Expansion Links

The assembly thus far completed, can now be erected. If the bearing bushes are taken out of the expansion link brackets, it will be found easy enough to wangle the expansion links into place, although their width over trunnion pins is wider than the brackets. The $\frac{3}{8}$-in. holes forming the bush housings in the brackets allows the expansion link to be put in skew-wise, one pin at a time. When in place, hold it so that the trunnion pins are in the middle of the big holes, then put in the bushes ; when these are pushed right home, it should be possible to swing the link easily back and forth, but without appreciable side movement, as the ends of the bushes should practically touch the trunnion brackets at each side of the link. Then put the screws in the bush flanges, and tighten up. If a centre-pop is made on the edge of the bush flange, at the highest or lowest point, just as you prefer, before taking out the bushes to erect the links, there won't be any trouble in replacing the bushes so that the screwholes line up correctly.

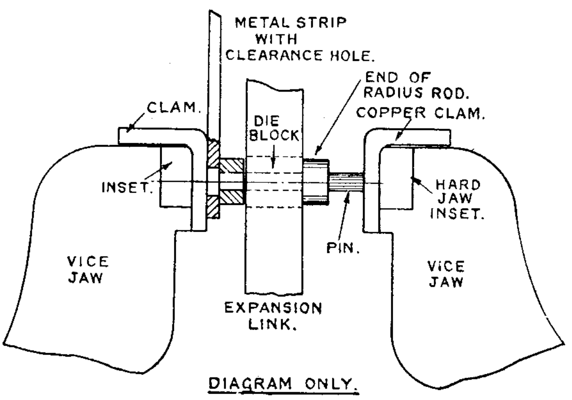
On the drawing of the link brackets, I showed roundhead screws holding the bush flanges to the brackets. This was because big sister has cup-headed bolts for this purpose, nutted inside the brackets, an arrangement which would have been a fiddling wrist-watch job in the $3\frac{1}{2}$-in. gauge engine. You'll find that you can tighten up the screws on the inner side of the bracket all right, by careful manipulation of a long thin screwdriver (I make all sorts of screwdrivers, to suit various jobs) or a bent screwdriver, made from a bit of $\frac{3}{16}$-in. round silver-steel, could be used. Alternatively, hexagon-head screws may be used, and tightened up with a small spanner, made from a strip of $\frac{1}{8}$-in. brass with a nick in the end. These improvised spanners take about a minute to make, they don't cattle up the corners of the weeny hexagons, and they open out and slip, rather than twist off the heads of the screws, so are O.K. for any of our fraternity who are inclined to be ham-fisted.

How to Erect Lap-and-lead Movement

This is just a piece of cake. Nutted pins, as mentioned in the first paragraph, are used throughout. Attach the union link to bottom of combination lever first, then put that in place between jaws of valve crosshead, and secure with a pin. Next, couple up the forked end of the radius rod to the top of the combination lever, using another nutted pin, and finally connect the loose end of the union link to the drop arm on the crosshead. The whole issue should then appear the same as on the general arrangement and valve-gear drawings.

Reversing Shaft Assembly

The reversing shaft is a piece of $\frac{1}{4}$-in. round steel, mild or silver as you prefer, squared off in the lathe to a length of $6\frac{1}{2}$ in. Put the right-hand



How to press in dieblock pins

lifting arm on it about 1/32 in. from the end, and pin it to the shaft by drilling a No. 43 hole through boss and shaft, and squeezing in a pin made from 3/32-in. steel. Now you need two bronze or brass washers, $\frac{5}{8}$ in. diameter, $\frac{1}{16}$ in. thick, with $\frac{1}{4}$ in. hole through the middle. They can be parted off a piece of drilled rod held in the chuck, or made from sheet. Put one on the shaft, next the lifting arm, and poke it through

the bearings in the two brackets, from the right-hand side. Put the other washer on the other end when it comes through the left side; then hold the left-hand combined lifting and reversing arm in place, with the lifting arm over the expansion link, and squeeze the end of the reversing shaft through it. Adjust so that each lifting arm is centrally over the expansion link, which should swing freely between the two halves. The reversing shaft should have just the weeniest bit of end play, so that it works easily. Couple the ends of the lifting links, to the upper ends of the lifting arms, by nutted pins.

The next, and an extremely important job, is to adjust the two lifting arms so that they are dead parallel. If not, when you think you have the gear in middle, one side will be in forward gear, and the other in reverse; I've seen plenty like that, one of them being a specially-made $2\frac{1}{2}$-in. gauge commercial job costing well over £100 pre-war! Yet it is *so easy* to make the adjustment. Set one side—doesn't matter which—so that when you waggle the expansion link by hand, the radius rod doesn't move. Jam the reverse shaft temporarily in that position, and waggle the other link. If the radius rod on that side doesn't move, you have a good straight eye; but the chances are a million dollars to a pinch of snuff that it will. O.K., all you have to do, is to adjust the lifting arm on the shaft, until it doesn't. When you can waggle either link, and the radius rods don't move with the reverse shaft fixed in one position, both lifting arms are parallel, and you can pin the second arm to the shaft, same as the first one, Incidentally, the easiest way of holding the reverse shaft still, is to put the screw in temporarily. Take the "gland nut" out of the back bearing, drop the reversing nut in the slots in the reverse arm, enter the screw in it from the back, screw home, so that the front spigot enters its bearing, and replace the "gland nut." Turning the screw will then operate the arm, and raise and lower the lifting links.

How to Fit Return Cranks, and Get Length of Eccentric-rods

Now we come to the bit where a simple pair of dividers, plus a bit of common "savvy" can beat the slide-rules, logarithms, equations, etc., beloved of Messrs. Knowitall & Co. Unlimited, to a complete frazzle. Put the return cranks on the main crankpins, with the return crankpins following the main pins, and approximately $\frac{7}{16}$ in. between the centres of return crankpin and driving axle. Take the reversing screw out again, so that you can operate the reverse arm quickly, by hand. Set the main crank on front dead centre. Now set the expansion link in such a position that you can run the die block up and down the link, without any movement of the radius rod; temporarily jam it in that position with a wooden wedge, or by any other convenient means. Set your dividers to the centres of the return crankpin, and the hole in the link tail. Shift the wheels to back dead centre, and try again, with the dividers at the same setting. It will be a miracle if they tally, the chances being about equal to a goalkeeper scoring from a clearing kick; but all you have to do, to make them tally, is to shift the return crankpin, half the difference, and try again. When the distance between the centres of return crankpin, and the hole in the link tail, are exactly the same, with the main crank on either the front or back dead centre, the return cranks are correctly set; and the distance between the divider points, is the exact length of the eccentric-rod between centres of pinholes.

You already have the drawing of the eccentric-rod, so go ahead and make it to the outline given, using the dividers, as above set, to get the distance between centres. The other dimensions are same as drawing shows. Put a clamp over the boss of each return crank, tightening well up, so that the boss cannot shift on the pin; then very carefully put the No. 43 drill through the holes in the thickness of the boss, and drill through, cutting into the circumference of the crankpin. Don't "go randy" at this, as my old granny would have said, or the drill will "go phut." Finally, put a 3/32-in. reamer through each, and fit weeny bolts made from pieces of 3/32-in. silver-steel, turned down to 5/64 in. at each end, screwed 9-B.A. and furnished with nuts. The large end of the eccentric-rod should be a good fit on the return crankpin, and is secured by a commercial nut and washer. The fork is attached to the tail of the expansion link, by a $\frac{1}{8}$-in. nutted pin, made as previously mentioned. The reversing screw can then be replaced.

Valve Setting

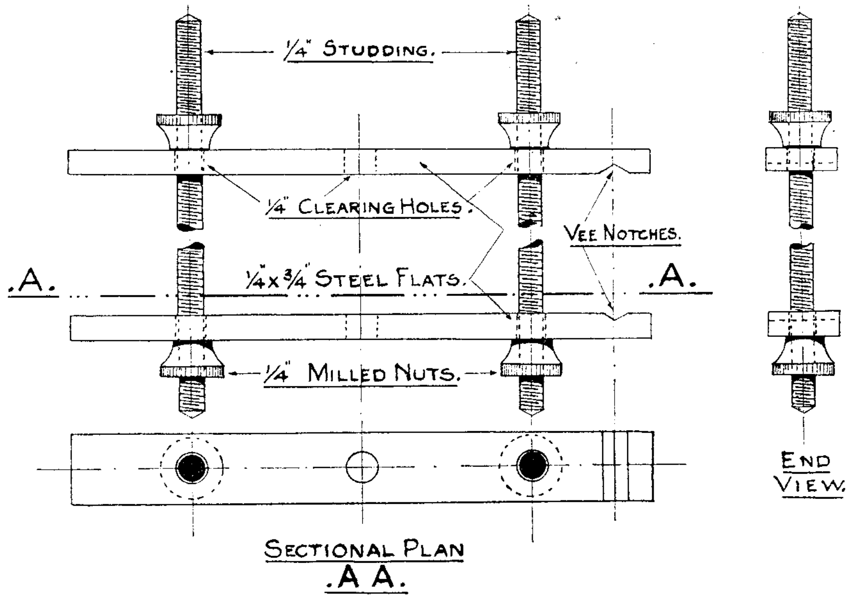
If the valve-gear is correctly made, and erected and adjusted as above, the valve setting merely boils down to ensuring that the ports "crack" on the dead centres in mid-gear. As the lead on Walschaerts gear in constant, you will get the same port crack on dead centre, whatever the position of the lever; and the valve-gear itself will look after the port opening, according to the position of the die blocks in the expansion links. The adjustment of the piston valves on the spindles, is merely a matter of trial and error. Rig up a temporary connection to the steam chests, so that they can be supplied with air from a motor tyre pump. I usually run a tap in the holes, and put a few threads in, then screw in stubs of copper pipe. The ends of these are connected, either by two bits of stout rubber tube, or by unions as desired, to a tee, the stem of which is screwed to take the connector of the tyre pump. Some tyre pumps have a slip-on connector operated by a thumb lever (the one I carry on my gasoline buggy is of that type) so the screw isn't necessary, in that case.

You already have openings in each end of the cylinders, as the drain cocks are not yet fitted. Put the lever in mid-gear, apply some air to the steam chests by gentle operation of the pump, and turn the wheels slowly by hand. Exactly as the crank arrives at the dead centre, there should be a loud "siss" from the hole where the drain cock will be fitted. If one "sisses" and the other doesn't, the valve needs adjusting on the spindle until you get equal "sisses" from both ends. Adjustment is also required if one end "sisses" louder than the other, or one end does it before

(*Continued on next page*)

USEFUL SOLDERING GRIPS

by S. F. Weston



THE grips illustrated above have been found to be most useful when either complicated or simple soldering or sweating has to be done.

The grips consist of two flat steel bars about $\frac{1}{4}$ in. × $\frac{3}{4}$ in. × 6 in. long, each drilled with three $\frac{1}{4}$ in. dia. clearing holes and with a vee-notch fitted at one end. These two bars slide on two lengths of $\frac{1}{4}$ in. dia. steel studding, each of which is provided with a $\frac{1}{4}$ in. dia. milled nut at each end. It will be seen that there is nothing difficult to obtain or make. The dimensions are simply mentioned as a guide; much lighter sections could be used for more delicate work.

The idea of the central hole is two-fold: it may be found sometimes more convenient to fit one of the screwed rods in this position, it may be used to embrace any projection on the work, or again they are useful as sighting holes when setting the work in the grips. When work is being gripped at one end only, a small block of wood, the same depth as the work, should be inserted at the opposite end to keep the bars parallel.

The parts to be soldered should be cleaned, tinned and flux applied, and then set up as required or centralised whilst the grips are gently brought together to hold the work firmly when the flame is applied.

The length of the screwed rods should be about 12 in. and the bars operated at one end, the projecting end of the rods thus form a convenient and cool handle for holding the work in the flame.

"L.B.S.C."

(*Continued from previous page*)

dead-centre, and the other afterwards. If, despite all adjustments, you don't get a "siss" until *after* the crank passes dead centre, the valve bobbins are too long on the inner edges, and a weeny bit must be taken off them; make quite sure that both are exactly the same length. It is best to try the lengths with a "mike." When air starts to blow from the cock-holes a weeny bit before dead centre, and quite heartily on the dead centre, both ends alike, the valves are correctly set, and the lock-nuts can be tightened; but here, another very necessary warning: The valves must "float" on the spindles; that is to say, while they must have no appreciable end-play between the lock-nuts, they must be easy enough to spin freely on the spindle by thumb and finger, when all the nuts are locked tight. If this condition doesn't obtain, and the nuts grip the valves, the liners will soon go all shapes, and will probably become scored as well; then you've "had it." Next item, lubrication arrangements.

IN THE WORKSHOP

by "Duplex"

No. 117.—Using the Drilling Spindle

EARLIER in these articles, reference has been made to the use of the tailstock drilling spindle for the purpose originally intended, that is, for drilling work held in the chuck, as illustrated in Fig. 1. The capacity of the chuck fitted to the spindle is 5/32 in. diameter. This dimension is somewhat larger than the device can handle comfortably, for it was formerly used for drilling holes in carburettor jets and similar work. The holes were small, and varied in size from No. 80 to No. 60.

When using the drilling spindle for work of this nature, the part is rotated in the opposite direction to the drill. This method, to some extent, increases the cutting speed, but, more important, it keeps the drill on a straight course.

If the drill is allowed to project only a short distance from the chuck jaws there is no need, first, to centre-drill the work, as the drill will centre itself.

When the spindle is driven from an overhead shaft the device may be arranged to give speeds that will enable the full capacity of the chuck to be used. The device can then be employed for the rapid drilling of pilot holes.

In addition to using the drilling spindle for its original purpose, that is for drilling axially any work that is held in the chuck, the attachment may also be employed when mounted on the top-slide of the lathe.

When the spindle is used in this way, holes that are off centre may be drilled in work held in the chuck. Examples showing the spindle mounted for this type of work are seen in Fig. 2 and Fig. 3.

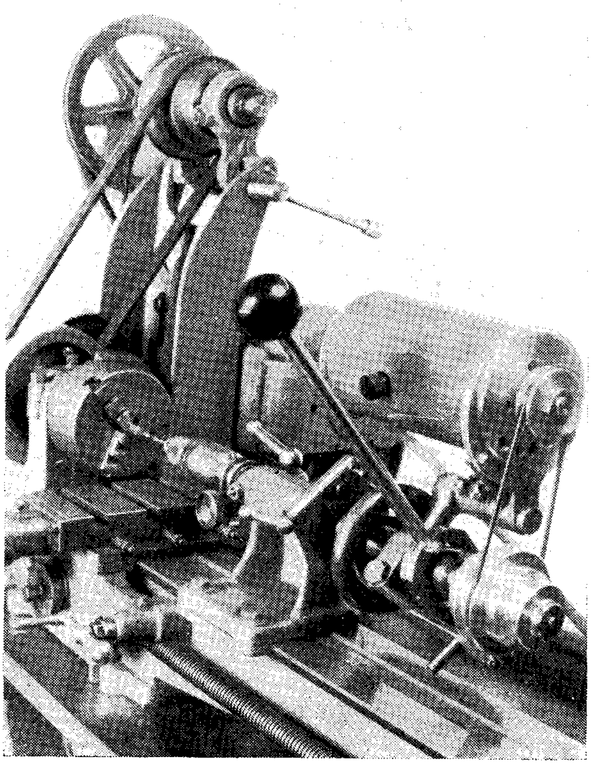


Fig. 1. The spindle in use drilling work held in the chuck

In order to mount the device on the top slide, the clamping-piece shown in the illustration Fig 4 must be made. This component is similar to the clamps used with boring tools ; in fact, this clamp, when made, can be used to hold a boring tool as well as for holding the drilling spindle.

The dimensions of the part are given in the illustration ; these figures apply to the Myford M.L.7 lathe and are calculated to set the axis of the drilling spindle at lathe centre height. The bore of the clamp is designed to hold a tailstock barrel of $\frac{3}{4}$ in. diameter ; to accommodate larger tailstock barrels, the clamp will need to be modified. Care must be taken, however, to see that the centre-line dimension is maintained.

Making the Clamp-Piece

The clamp-piece is made from a piece of mild-steel. The material is first sawn roughly to the dimensions shown in the drawing. The work is then mounted in the four-jaw chuck so that the clamp can be machined to size. The best way to ensure that the bore of the clamp is exactly on the lathe centre-line is to machine the work by means of a boring bar mounted between the lathe centres. In this way the bore will be both parallel and at centre height.

The work is first mounted on the top-slide and is set in axial alignment with the centre-line of the lathe by means of a dial test indicator. The material is next centre drilled and then pilot drilled in order that a drill giving ample clearance for the boring bar may be passed through the long axis of the work.

The boring bar

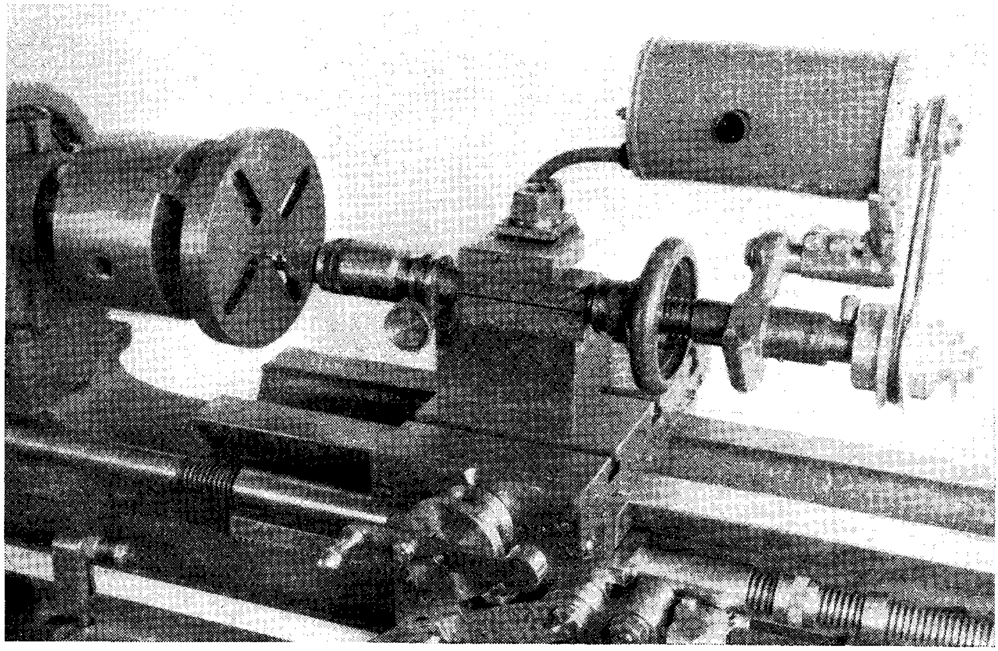


Fig. 2. The motor-driven drilling spindle mounted on the cross-slide of a Drummond lathe

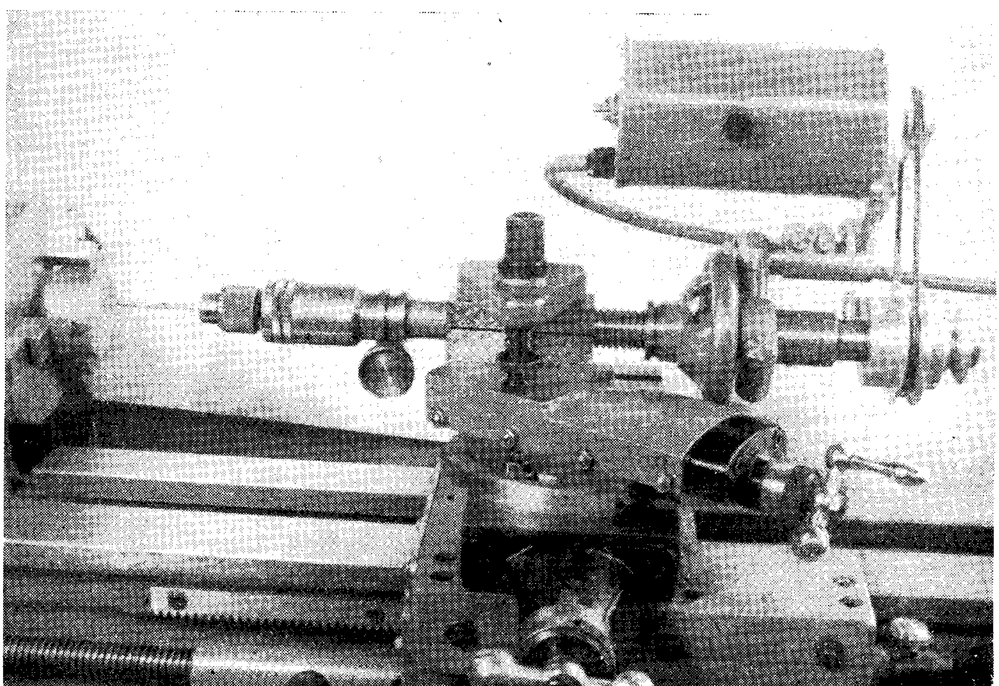


Fig. 3. The spindle in use on a Myford M.L.7 lathe

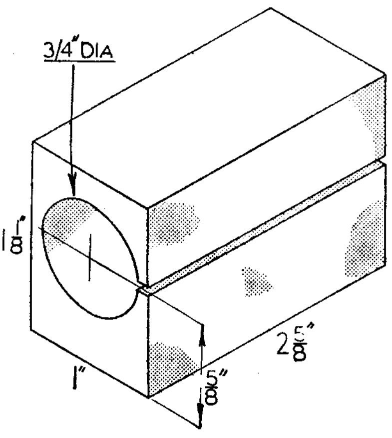


Fig. 4. *Clamp-piece for securing the drilling spindle to the top-slide*

is now inserted through the clearance hole and is mounted between the centres of the lathe. Light cuts should be taken when machining the bore, and great care must be taken to make the drilling spindle a firm push fit in the finished bore.

When the clamp has been bored, a mark should be made on one end. This mark will enable the part to be replaced on the top-slide facing in the same direction as when the boring was carried out. This is important ; if the clamp is reversed, the drilling spindle may not lie parallel with the surface of the lathe bed.

The clamp must now be split. This may be done by means of a hand hacksaw or with the aid of a power hacksaw, as described in a previous article.

After the splitting operation has been completed, a frosted finish may be applied to the clamp, using the methods described in an article entitled "Scraping, Frosting and Figuring Flat Metal Surfaces," published on March 20th, 1952.

When the spindle is used in the manner illustrated in Fig. 2 and Fig. 3, the work is, of course, stationary. The lathe mandrel must, therefore, be locked. If the work is not important, it will suffice to put the lathe into back gear whilst the mandrel pulley remains locked to the mandrel. In this way the work will be held against rotation, but will not be positively locked, because any small movement between the wheels of the back gear and any shake in the pulley locking arrangements will prevent this.

If the work is of a critical nature, then some form of mandrel lock must be employed.

The spindle itself must, of course, be set in axial alignment, employing a dial test indicator for the purpose. The indicator is applied first to the head of the screw securing the driving dog of the pulley and then to a button, having the same diameter as the screw head, held in the chuck of the drilling spindle. In order to use this method for checking the alignment of the spindle, the screw head must run true. Provided that the tapped hole in the spindle has been carefully formed, there should be no difficulty in ensuring that it does so ; but it is advisable to machine the head of any screw not specially made for the purpose.

A simpler way of setting the spindle, and one that is perhaps scarcely less accurate than the method just described, is to register one end of the spindle with a lathe centre mounted in the mandrel whilst the opposite end of the spindle is aligned with a centre mounted in the tailstock. In order to do so, the jaws of the drill chuck are opened to admit the point of lathe centre whilst the screw head at the opposite end of the spindle is provided with a coned axial hole to accommodate the tailstock centre.

For all practical purposes this method may be used with confidence.

Mounting the Drilling Spindle on the Drill Column

When there is work that needs to be drilled at speeds higher than those that can be obtained

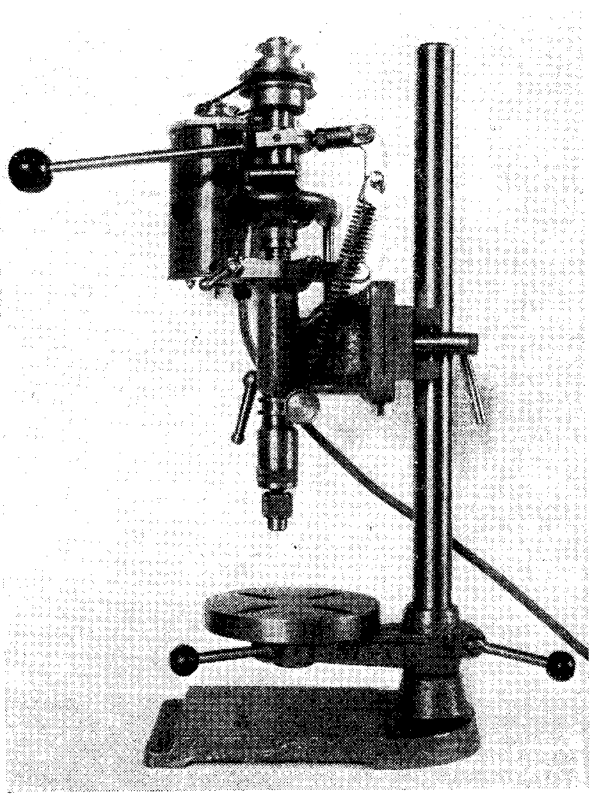


Fig. 5. *The spindle mounted on the column of the drilling machine*

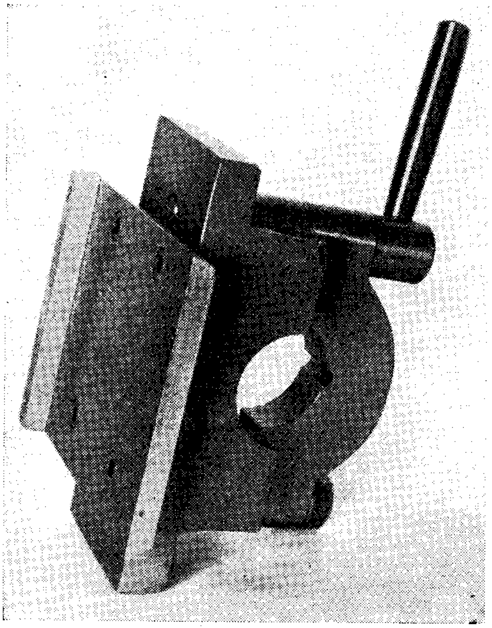


Fig. 6. The column mounting for the drilling spindle

from the normal drilling machine, the complete tailstock with its drilling spindle and motor may be attached to the column of the drilling machine in the manner illustrated in Fig. 5. Such an arrangement has much to recommend it, for the whole tailstock may be removed or replaced in far less time than it takes to describe the operation.

Moreover, by means of the special column mounting seen in the illustration and also in Fig. 6 the whole device may be quickly adjusted for height. In adition, when setting the work the spindle may be locked by means of the tailstock clamping lever.

The mounting is contrived from a standard Myford V-block having a steel clamp attached. The clamp, illustrated in Fig. 7, is supported on two tubular distance-pieces whilst both the clamp and the V-block are machined to accommodate the column of the drilling machine. As will be observed from the details of the components seen in the illustration Fig. 8, one of the distance-pieces is subsequently shortened by 0.003 in. to allow the device to clamp the drilling machine column.

In order to machine the work, the clamp and V-block are mounted on an angle-plate attached to the faceplate of the lathe. The clamp itself has a vee formed in it to conform with the vee in the V-block ; by this means the setting of the work is simplified. A stout boring tool should be used when machining the two parts.

Of the making of the clamp lever, and the distance-pieces, nothing need be said, for the work is elementary.

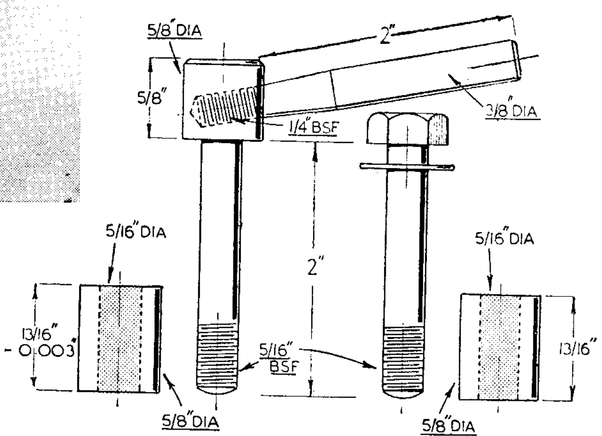


Fig. 8. The clamp-bolts and distance-pieces

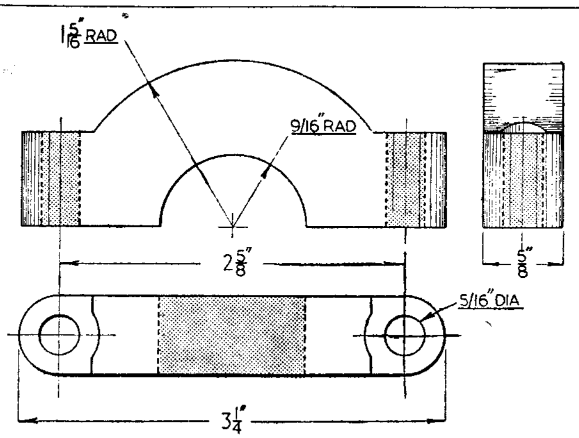


Fig. 7. Details of the steel clamp

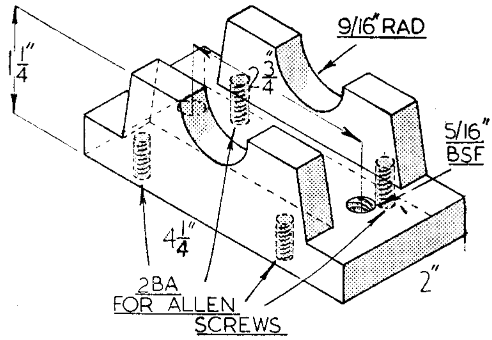


Fig. 9. The V-block

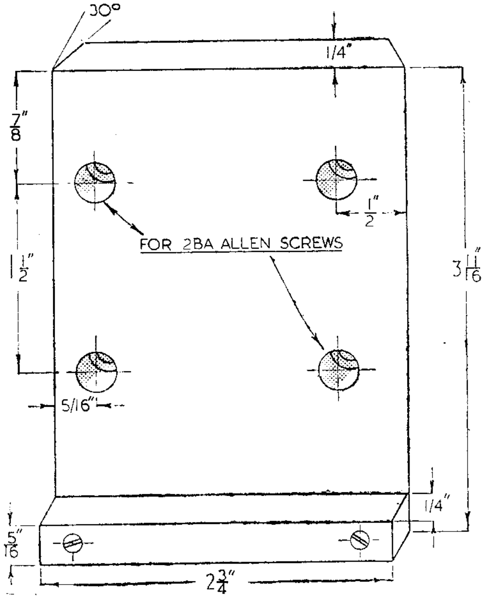


Fig. 10. The mounting plate

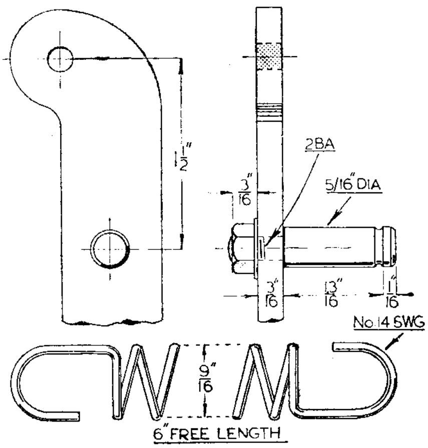


Fig. 11. Details of the spring anchorage and spring

The plate, having angular ways to accommodate the base of the tailstock, is cut from a piece of ¼ in. thick mild-steel. The plate, as will be seen from the different illustrations, is fitted with a buffer strip to prevent the tailstock falling until it can be locked in place by means of the lever seen on the far side of the base casting. Allen screws are used to secure the plate to the V-block; before drilling the necessary holes in the V-block, however, the plate must be set in vertical alignment by means of a set-square placed on the work table of the drilling machine with its blade applied to the right-hand edge of the plate, that is to say to the edge that makes contact with the standing tenon of the tailstock base.

In order to fit the tailstock and its drilling spindle for use in a vertical position, no major modification is needed but a return spring must be fitted to hold the spindle in the raised position. One end of the spring is attached to a stud fitted on the link of the lever-feed device. The opposite end of the spring is attached to the clamp screw securing the head of the drilling spindle in place.

Catalogue Received

We have been favoured with a copy of a new catalogue from A. J. Reeves & Co., of 416, Moseley Road, Birmingham. We would call it to the attention of any reader who thinks of building almost any of "L.B.S.C.'s" small locomotives, for particulars and prices of an enormous selection of castings and parts for a long list of these engines are given.

This firm also carries in stock a useful range of workshop equipment including: Myford, Boxford, Harrison and Haighton Lathes; Fobco, Union and Champion drilling machines; Selecta grinding machines; Pool bench milling machines; Wolf electric tools; Burnerd chucks; Cardinal and Belco drill chucks; Hoover and Brook electric motors; various hand tools, small tools, paint spray guns and much useful material for model engineers.

Reeves are the sole suppliers of castings and parts for the Allchin "M.E." 1½-in. scale traction engine designed by Mr. W. J. Hughes. They also provide similar supplies for their own 0-6-0 tank locomotives *Gert*, *Daisy* and *Vera*.

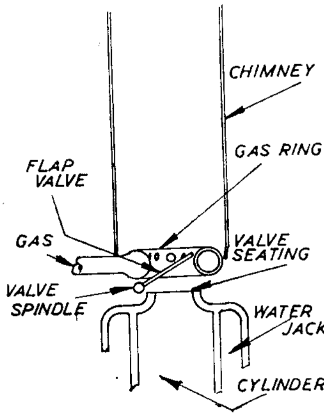
Finally, a selection of simple steam engine kits and a wide range of steam fittings should appeal to a large number of our readers.

PRACTICAL LETTERS

The Lowne Engine

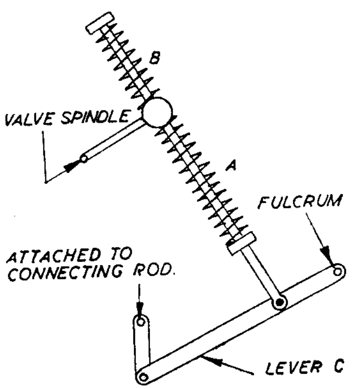
Dear Sir,—I was very interested in B.C.J.'s reference to the Lowne vacuum engine, as I had access to one many years ago. I enclose the two very rough sketches from memory, to show the working of the valve, which I hope you may find comprehensible.

The lever *C* was connected to the main



Arrangement of flap valve in Lowne atmospheric engine

connecting-rod and moved in phase with it, thereby pushing a long rod (visible in B.C.J.'s picture) up and down. This rod passed through a clearance hole in a block attached to the valve-lever and carried two very weak springs *A* and *B*.



Valve-actuating gear

Starting from top dead centre with the valve open, as the piston descended it drew the flame from the gas-ring into the cylinder, which thus became full of hot gases. It also, through the lever and rod, caused spring *B* to lower the valve, which was thus pressed on to its seating slightly before bottom dead centre. The gases trapped in the cylinder at atmospheric pressure were then cooled by the water-jacket, thus reducing the pressure in the cylinder below atmospheric, the pressure of the atmosphere on the underside of the piston then pushing it up, the flap-valve meanwhile also being held on its seating by atmospheric pressure on its upper surface. The spring *A* was compressed by the rising piston, and when the pressure in the cylinder rose to atmospheric again due to the upward movement of the piston, forced the flap-valve to flick open just before top dead centre, thus exhausting the burnt gases. The cycle then repeated.

The engine I knew was barely able to turn itself, and the adjustment of the valve springs was very critical. This was probably due to leaks between the valve and its seating.

Yours faithfully,

Wembley. S. H. Rutherford.

Electric Clock Pendulum Swing

Dear Sir,—With regard to Query No. 9955 from E.D. (Camborne), perhaps I can further assist in ironing out his difficulties in the efficiency of the $\frac{1}{2}$-sec. Hipp clock he is making.

I completed a similar clock last January, and it is now working satisfactorily but not with absolute time-keeping accuracy. With a new battery the clock did actually achieve the 30 sec. impulse quoted in Mr. F. Hope-Jones's book. The impulses rapidly dropped down to 20-22 sec. but have remained constant since early February last. The following are the points to watch during construction.

(1) The fastening holes in the backplate are not in a suitable position for screwing to the wood base of the clock. Four screws should be used for the purpose, two of them high up, and on a line with the centre of the suspension bracket, and two *below* the yoke and coils.

This will prevent buckling of the backplate, which should be made of at least $\frac{1}{8}$ in. thick material.

(2) The book does not give dimensions for depth of "V" in impulse block; my experiments proved that 0.010 in.-0.015 in. was quite suitable and anything deeper than that gave much quicker impulses.

(3) It is essential to have the trailer vane perfectly square with the "V" in the block, and should swing very freely.

(4) With the pendulum stationary, and the contacts closed, any tendency to pull to one or the other pole should be corrected by means of the adjustment-screws on yoke adjustment arm, to give an even pull on armature.

Finally, I would suggest varying in turn the position of the trailer vane on the pendulum-rod, and the air gap between armature and magnets until the best results are obtained.

Yours faithfully,

Liverpool. G. E. Tarbuck.

Pendulum Swing

DEAR SIR,—The letter from E.D., of Camborne, No. 9955, rather suggests that the current in the magnet coils of his clock is not cut off soon enough.

If the pendulum bob or armature is held in the hand and brought very slowly from the swing extremity to the centre, the pull can be felt. It increases up to a certain point and then falls off as the armature reaches a central position with respect to the poles. The contacts should open when the reduction of "pull" is noticed.

As you so rightly remark, the ball-bearing suspension does not meet with approval in the best circles. If E.D. does not like the "conventional feather," why not use a Reifler knife edge? Ball-bearings *can* be quite stiff, and are capable of wasting quite a lot of energy!

Yours faithfully,
Lymington. A. RICKARD TAYLOR.

Steam Organs and Other Matters

DEAR SIR,—I have been a subscriber to THE MODEL ENGINEER since only January 1st, 1952, but have meant to write several times. Once in connection with the breech mechanism for a saluting cannon. The solution published for this query is exactly like the Winchester yacht cannon breech made in this country. On the test for stainless-steel, we use the spark test, and to be really sure, coat the piece with copper sulphate solution as used by diemakers for layout work. If the copper sulphate doesn't "take" you can be sure the steel is stainless.

A recent issue carried a query about steam organs—we call them steam calliopes. I can remember at least one of these and also can recall my disappointment at seeing them converted to air. But here's the big news. During May there was a circus coming to town and I hear they have a genuine steam calliope. Being a member of the sponsoring organisation I feel very hopeful about being able to get some real information on this "machine" and if it works out this way I'll try to send you details and photographs for your readers' benefit. I hope this one hasn't been converted to air but it may have been, so don't be too hopeful.

Your editorial comment on the demise of *The Live Steamer* was very nicely done. It was a grand little paper and put out by a grand guy. George is only 30 miles away so I know him quite well and believe me he is heart and soul in live steam. I am now anxiously awaiting Dick Bagley's new magazine.

The main reason for writing you is to tell you what a fine magazine THE MODEL ENGINEER is and how much I thoroughly enjoy it. I still can't believe that such a magazine can be published once a week and never lack for material.

My modelmaking at present is all taken up with an 0-4-0T $3\frac{1}{2}$-in. gauge to Carl Purinton's design. This is a culmination of a boyhood spent with an "O"-gauge L.M.S. Mogul by Bassett-Lowke and a 4-4-0 $1\frac{3}{4}$-in. gauge by the same firm. With three youngsters in the family it's hard to find much time for the shop, but she's progressing slowly and is lots of fun. The New York, New Haven and Hartford R.R. is now without steam. Pacific No. 1388 made her last run yesterday with a load of "railfans" and is now retired. *O tempora! O mores*!

The fire is thin and the blast getting weak, so I'll dump the fire and again express my thanks for a fine magazine.

Yours faithfully,
Connecticut, U.S.A. H. I. TREADWAY.

Supplies for Small Electric Motors

DEAR SIR,—In my book *Small Electric Motor Construction*, I included a list of "Some Suppliers" of material, with the caution that although the particular firms mentioned had been very obliging in supplying small quantities in the past, it might not always be convenient or economical to them to supply such small orders.

However Messrs. H. Rollet & Co. Ltd. (brass, copper, etc.) have written to me to say that they are particularly equipped to supply small quantities, and such orders should be addressed to their address at 6, Chesham Place, London, S.W.1. Under the circumstances I think it only fair to them that this information is published. Also please note, their name was mis-spelt in the book in question. Perhaps I should add that I have no interest in this firm other than as a satisfied customer for many years.

Yours faithfully,
Sheffield. J. GORDON HALL.

Buffer-operated Brakes

DEAR SIR,—I was interested to read Mr. B. Jeffries' article on over-run brakes for railway trucks.

To be successful a radical change in truck design is called for. The destructive hook and chain coupling must be scrapped in favour of the fork and pin used on the Underground. In this system the towing fork is floated between the thrust and drag shock-absorbing springs and a toggle movement could be used to operate the brakes with a thrust from either direction. The essential feature of adjustment is that the brakes will not commence to operate until the drawbar pull exceeds that of the engine under normal maximum load conditions.

Brakes are operated by an accelerating force irrespective of direction. The accelerating force in this case depends on the number of trucks that are pushing or pulling, but as you have to deduct the reaction of the brakes it is quite possible that the actual braking effort due to each truck affected is equal. Naturally, a disengaging and manual control would be incorporated. These over-run brakes are quite successful on automobile trailers and no bother is found with them when reversing.

The problem of pre-loading is one that I came up against the other day when trying to solve the mystery of why the shock-absorber of a whale catcher would not recoil when the load came off the harpoon line.

As Mr. Jeffries remarks, perhaps "L.B.S.C." or some expert on modern railway practice could be persuaded to comment on this problem.

Yours faithfully,
East Ham. A. E. CLAUSON.
Grad.I.E.D., Grad.I.Prod.E.

Electronic Organs

DEAR SIR,—I hate to rush into print, but feel a serious effort should be made to counteract the "wet rag" effect of a letter by A. L. Hutton on the subject of "Electronic Organs." I could take this gentleman to a most delightful, and efficient, amateur home-built organ of 2-manuals and about 30 stops. Further, the original form of this organ was a 2-manual harmonium. As the reeds are not used magnetically but electrostatically it does not matter what metal they are made of. Perhaps Mr. Hutton does not know the "silent reed" principle. The "high polarising voltages" are no higher than those used in domestic radio and there is nothing "tricky" about the method of application which follows well known principles and design.

I am in full agreement with Mr. Hutton as to the excellencies of the Compton Electrone—perhaps he does not realise that the prototype of this wonderful instrument was home-constructed in the days when ex-service components were not available, and valves, etc., very elementary. I also wish Mr. Siddons the very best of luck and sincerely hope he will prove that he can do it.

Yours faithfully,

Petts Wood, Kent. "ELECTROPHONE."

Double Pendulum Miniature Clock

DEAR SIR,—I was very interested in the photograph of the little clock owned by Mr. R. H. Pilcher, and whilst I have not actually seen one like it, I may be able to offer a little helpful information.

The escapement is the double pendulum one invented in 1735, by Jean Baptiste Dutertre of Paris, for a marine chronometer. The underlying idea was that with the pendulums geared together, any movements of the ship would have equal, but opposite effects on the pendulums; needless to say the idea was a failure. Dutertre was a very skilled clockmaker of his day, and it is queer that he should have overlooked the obvious fallacies of this invention. To the best of my knowledge he built only one clock employing this escapement, and that was one with ½-seconds pendulums.

With regard to the age and origin of Mr. Pilcher's clock, I would offer two suggestions. Either it was made by Dutertre or a friend as a novelty round about that time, or it was made by some unknown maker between say 1800-1850 or thereabouts, a period when horological novelties were very popular. I think the first suggestion is the most probable. In either case I would say it is of French make.

Judging from the photograph, the relative sizes of the pendulum rods and bobs would bring the centres of gravity nearly a quarter way up the rods and Mr. Pilcher is correct in assuming that they do not function as true pendulums. On the other hand they are not the same as a foliot which has a definite periodicity, and is free in a way that two geared pendulums are not.

I hope that I have been of some slight help. If Mr. Pilcher cares to write to me, and I would like him to, I may be able to help him further.

Yours faithfully,

Exeter. JOHN W. CASTLE.
A.M.B.H.I.

CLUB ANNOUNCEMENTS

The Society of Model and Experimental Engineers

On May 8th the society enjoyed an extremely interesting lecture by Mr. I. P. Millar on the *S.S. Robert Allen*. The lecturer first dealt with the construction of the hull and the steps taken to ensure that it was a correct reproduction of the prototype. He then passed on to the machinery, which by various ingenious devices has attained a certain degree of automaticity, so that when steam is shut off the "fires" are damped down. He then proceeded to the radio control, and this proved so interesting that the chairman had some difficulty in closing the meeting at the time appointed.

The next meeting of the society, a joint occasion with the Society of Ornamental Turners, is on June 14th, at 2.30 p.m., at the Caxton Hall. The lecturer, Mr. Tweddle, will take as his subject the tools and methods used in "Ornamental Turning." We are assured of a good display of examples of this art, which is now enjoying a revival.

Full particulars of the society may be obtained from the Secretary, E. C. YALDEN, 31, Longdon Wood, Keston, Kent.

The Bristol Society of Model and Experimental Engineers

In a very interesting talk entitled "Measuring-tool Topics" given to the society on May 3rd, by Mr. A. E. Kerswell, he described among other things the construction of an engineer's protractor, an inside micrometer and a depth micrometer; these useful additions to any workshop, thanks to Mr. Kerswell's most explicit instructions, are probably taking shape in many members workshops.

At the last meeting on May 14th, members enjoyed a talk given by Mr. Jermyn, who is a B.B.C. engineer, on "Broadcasting Procedure." Mr. Jermyn described, first, the organisation behind every broadcast programme and went on to tell of the special technique of outside broadcasting, concluding with a description of the treatment of acoustic problems. In view of the numerous problems which Mr. Jermyn brought to our notice, members will probably in future have more sympathy for the B.B.C. when the announcer is forced to apologise for a "technical hitch."

The Farnborough Society of Model Engineers

On May 15th members of the society, together with some of those from the Aldershot Society, listened to a very interesting talk given by a fellow member, Mr. G. G. Harris, well known to most readers.

He was speaking on the comparison of model engineering in the early days and now, and in his idea modellers were rather spoon-fed as compared to his day, so that much of the craftsmanship was lost.

He recalled many early trials with both model power boats and aircraft, also several amusing incidents. His list of awards are too numerous to mention, but it was interesting to note that he was billed in 1927 as the owner of the fastest motorboat in the world. Many of his earlier models were on show and members showed a great interest in all that was there and thoroughly agreed with the chairman that it had been both an instructive and interesting evening.

The society now has a membership of 55 and new members are always welcome and should get in touch with the Hon. Secretary, D. L. JENKINS, 16, Hurst Road, Hawley Estate, Farnborough, Hants.

Marlow S.M.E.E.

The annual exhibition will be held in the Church Hall, Marlow, on August 14th, 15th and 16th. Any other society, or lone hand, is invited to exhibit, and we shall be pleased to receive models of any description.

Hon. Secretary: J. HOBBS JNR., The Boathouse, Marlow-on-Thames, Bucks.